

SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: HOA VAN LE Examiner #: 60626 Date: 16 June 2004
 Art Unit: 1752 Phone Number 301-571-272-1332 Serial Number: 101079, 873
 Mail Box and Bldg/Room Location: REM 9D61 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: _____
 Inventors (please provide full names): _____
 Earliest Priority Filing Date: _____

For Sequence Searches Only Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.

Please search for compounds as disclosed in the general claims 1, 21, 23 and especially the attached compound (A)

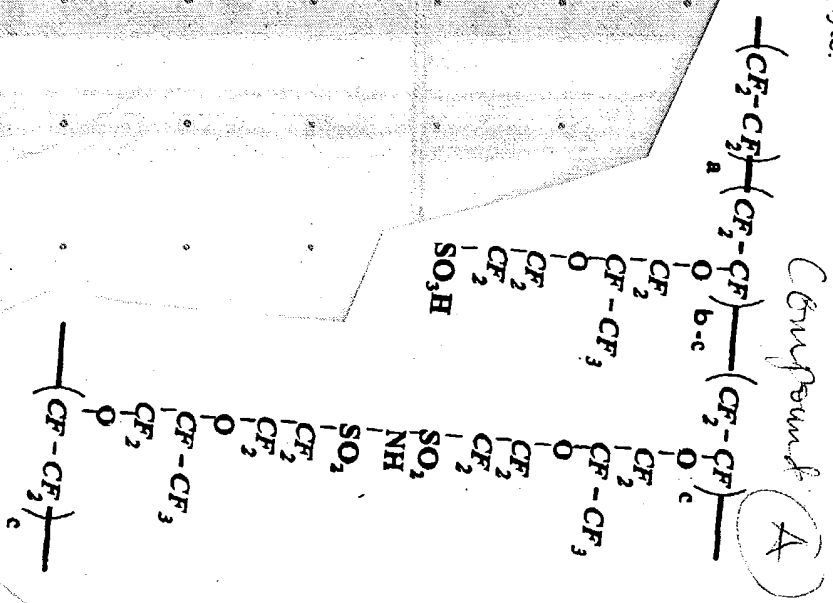
Helps are on figures 1 and 2.

(Tried to print out the closest art first.)

STAFF USE ONLY

	Type of Search	Vendors and cost where applicable
Searcher: <u>EL</u>	NA Sequence (#) _____	STN _____ \$500.00
Searcher Phone #: _____	AA Sequence (#) _____	Dialog _____
Searcher Location: _____	Structure (#) <u>✓ (4)</u>	Questel/Orbit _____
Date Searcher Picked Up: _____	Bibliographic <u>✓ (4)</u>	Dr. Link _____
Date Completed: <u>6-24-04</u>	Litigation <u>✓</u>	Lexis/Nexis _____
Searcher Prep & Review Time: <u>20</u>	Fulltext _____	Sequence Systems _____
Clerical Prep Time: _____	Patent Family _____	WWW/Internet _____
Online Time: <u>100</u>	Other _____	Other (specify) _____

Applicants note that the above elected species can result in the following modified electrolyte:



=> file reg

FILE 'REGISTRY' ENTERED AT 20:50:57 ON 24 JUN 2004

USE IS SUBJECT TO THE TERMS OF YOUR STN CUSTOMER AGREEMENT.

PLEASE SEE "HELP USAGETERMS" FOR DETAILS.

COPYRIGHT (C) 2004 American Chemical Society (ACS)

=> display history full l1-

FILE 'HCAPLUS' ENTERED AT 18:21:46 ON 24 JUN 2004

L1 124481 SEA TANAKA ?/AU
L2 1289 SEA USUKI ?/AU
L3 841 SEA KAWASUMI ?/AU
L4 14824 SEA MORIMOTO ?/AU
L5 32874 SEA HASEGAWA ?/AU
L6 26182 SEA NAKANO ?/AU
L7 8064 SEA KAMIYA ?/AU
L8 1 SEA L1 AND L2 AND L3 AND L4 AND L5 AND L6 AND L7
SEL L8 1 RN

FILE 'REGISTRY' ENTERED AT 18:23:11 ON 24 JUN 2004

L9 56 SEA (107-10-8/BI OR 109-72-8/BI OR 109-73-9/BI OR
L10 13 SEA L9 AND PMS/CI
L11 7 SEA L10 AND NO RSD/FA
D L11 1-7 IDE
SEL L11 1-6 RN
L12 6 SEA (418770-63-5/BI OR 474100-51-1/BI OR 474100-53-3/BI
OR 474100-56-6/BI OR 474100-59-9/BI OR 474105-84-5/BI)

FILE 'HCA' ENTERED AT 18:33:45 ON 24 JUN 2004

L13 3 SEA L12

FILE 'REGISTRY' ENTERED AT 18:34:21 ON 24 JUN 2004

E TETRAFLUOROETHYLENE/CN
L14 1 SEA TETRAFLUOROETHYLENE/CN
D RN
L15 4276 SEA 116-14-3/CRN
E PERFLUOROVINYL ALCOHOL/CN
E 1,2,2-TRIFLUOROVINYL ALCOHOL/CN
E VINYL ALCOHOL, PERFLUORO-/CN
E VINYL ALCOHOL, 1,2,2-FLUORO-/CN
E VINYL ALCOHOL, 1,2,2-TRIFLUORO-/CN
E C2HF3O
E C2HF3O/MF
L16 6 SEA C2HF3O/MF
E ETHENOL, TRIFLUORO-/CN
L17 1 SEA "ETHENOL, TRIFLUORO-"/CN

L18 4 SEA 50675-71-3/CRN
L19 0 SEA L18 AND L15
E PERFLUOROETHYLENE OXIDE/CN
L20 1 SEA "PERFLUOROETHYLENE OXIDE-PERFLUOROMETHYLENE OXIDE
COPOLYMER"/CN
L21 31 SEA 694-17-7/CRN
E PERFLUOROPROPYLENE OXIDE/CN
L22 1 SEA "PERFLUOROPROPYLENE OXIDE"/CN
D RN
L23 106 SEA 428-59-1/CRN
L24 3 SEA L15 AND (L21 OR L23)
L25 0 SEA L24 AND S/ELS
L26 2 SEA L9 AND I/ELS
D L26 1-2 IDE

FILE 'HCA' ENTERED AT 18:47:49 ON 24 JUN 2004

L27 2 SEA L26

FILE 'REGISTRY' ENTERED AT 18:48:15 ON 24 JUN 2004

E NAFION/CN

E NAFION

L28 215 SEA NAFION/BI
E AMMONIA/CN

L29 1 SEA AMMONIA/CN
E METHYLAMINE/CN

L30 1 SEA METHYLAMINE/CN
E ETHYLAMINE/CN

L31 1 SEA ETHYLAMINE/CN
E PROPYLAMINE/CN

L32 1 SEA PROPYLAMINE/CN
E ISOPROPYLAMINE/CN

L33 1 SEA ISOPROPYLAMINE/CN
E N-BUTYLAMINE/CN

L34 1 SEA N-BUTYLAMINE/CN
E ISOBUTYLAMINE/CN

L35 1 SEA ISOBUTYLAMINE/CN
E SEC-BUTYLAMINE/CN

L36 1 SEA SEC-BUTYLAMINE/CN
E TERT-BUTYLAMINE/CN

L37 1 SEA TERT-BUTYLAMINE/CN
E PERFLUOROMETHYLAMINE/CN

L38 1 SEA PERFLUOROMETHYLAMINE/CN
E PERFLUOROETHYLAMINE/CN

L39 1 SEA PERFLUOROETHYLAMINE/CN
E PERFLUOROPROPYLAMINE/CN
E PERFLUOROPROPYL AMINE/CN
E PERFLUORO-N-PROPYL AMINE/CN
E PERFLUORO-N-PROPYLAMINE/CN

E N-PROPYLAMINE, PERFLUORO-/CN
E C3H2F7N/MF
L40 5 SEA C3H2F7N/MF
E C4H2F9N/MF
L41 7 SEA C4H2F9N/MF

FILE 'HCA' ENTERED AT 19:03:19 ON 24 JUN 2004
L42 7111 SEA L28 OR NAFION#
L43 36306 SEA L29/D OR L29/DP OR (AMMONIA# OR NH3) (2A) (TREAT? OR
PRETREAT? OR MODIF? OR DERIV? OR ADDUCT? OR CONDITION?
OR PRECONDITION? OR PROCESS? OR PREPROCESS? OR CROSSLINK?
OR CROSS?(2A)LINK?)
L44 346162 SEA L29 OR AMMONIA# OR NH3
L45 146980 SEA (?AMINE OR ?AMINES) (2A) (TREAT? OR PRETREAT? OR
MODIF? OR DERIV? OR ADDUCT? OR CONDITION? OR PRECONDITION
? OR PROCESS? OR PREPROCESS? OR CROSSLINK? OR CROSS?(2A)L
INK?)

FILE 'REGISTRY' ENTERED AT 19:05:06 ON 24 JUN 2004
L46 22 SEA (L30 OR L31 OR L32 OR L33 OR L34 OR L35 OR L36 OR
L37 OR L38 OR L39 OR L40 OR L41)

FILE 'HCA' ENTERED AT 19:06:15 ON 24 JUN 2004
L47 1914 SEA L46/D OR L46/DP
L48 43052 SEA L46
L49 1455 SEA ?SULFONYLIMID? OR ?SULFONYL(2A) (IMIDO? OR IMIDE?)
L50 39 SEA ?SULFONYLCARBONYLIMID? OR ?CARBONYLSULFONYLIMID? OR
?SULFONYL(3A)?CARBONYL(3A) (IMIDO? OR IMIDE?)
L51 647 SEA ?CARBONYLIMID? OR ?CARBONYL(2A) (IMIDO? OR IMIDE?)
L52 31 SEA L42 AND L43
L53 223 SEA L42 AND L44
L54 84 SEA L42 AND L45
L55 7 SEA L42 AND L47
L56 25 SEA L42 AND L48
L57 1 SEA (L52 OR L53 OR L54 OR L56) AND (L49 OR L50 OR L51)
L58 31 SEA L52 AND L53
L59 4 SEA L52 AND L54
L60 5 SEA L52 AND L56
L61 8 SEA L53 AND L54
L62 8 SEA L53 AND L56
L63 9 SEA L54 AND L56
L64 5 SEA L42 AND (L49 OR L50 OR L51)

FILE 'REGISTRY' ENTERED AT 19:21:48 ON 24 JUN 2004
L65 627145 SEA (C(L)F(L)S(L)O)/ELS
L66 1201 SEA L65 (L) 4/ELC.SUB
L67 890 SEA L66 AND NO RSD/FA
L68 6708 SEA L65 (L) I/ELS

L69 445 SEA L68 AND NO RSD/FA
L70 38408 SEA L65 AND 1/H
L71 2721 SEA L70 AND NO RSD/FA

FILE 'HCA' ENTERED AT 19:31:01 ON 24 JUN 2004

L72 3865 SEA L67
L73 14341 SEA L71
L74 679 SEA L69
L75 715 SEA L42 AND (L72 OR L73 OR L74)
L76 66 SEA L42 AND L72
L77 659 SEA L42 AND L73
L78 4 SEA L42 AND L74
L79 13 SEA L76 AND (L43 OR L44 OR L45 OR L47 OR L48)
L80 37 SEA L77 AND (L43 OR L44 OR L45 OR L47 OR L48)
L81 2 SEA L77 AND L43
L82 30 SEA L77 AND L44
L83 8 SEA L77 AND L45
L84 1 SEA L77 AND L47
L85 1 SEA L77 AND L48
L86 53083 SEA L15
L87 748 SEA L86 AND L72
L88 1111 SEA L86 AND L73
L89 34 SEA L86 AND L74
L90 3 SEA L89 AND (L43 OR L44 OR L45 OR L47 OR L48)
L91 54 SEA L87 AND (L43 OR L44 OR L45 OR L47 OR L48)
L92 50 SEA L88 AND (L43 OR L44 OR L45 OR L47 OR L48)
L93 1 SEA (L91 OR L92) AND (L49 OR L50 OR L51)
L94 4 SEA (L76 OR L77) AND (L49 OR L50 OR L51)
L95 133 SEA AMIDIZ?
L96 2 SEA L42 AND L95
L97 3 SEA L86 AND L95
L98 638932 SEA ELECTROLY? OR ELECTROCHEM? OR GALVANI?
L99 42029 SEA FUELCELL? OR FUEL?(2A) (CELL OR CELLS)
L100 QUE (52 OR 72)/SC,SX
L101 40066 SEA SOLID?(2A) (POLYM? OR COPOLYM? OR HOMOPOLYM? OR TERPOLYM? OR RESIN?)
L102 64 SEA (L82 OR L91 OR L92) AND (L98 OR L99 OR L100)
L103 4 SEA (L82 OR L91 OR L92) AND L101
L104 56 SEA (L82 OR L91 OR L92) AND L98
L105 6 SEA (L82 OR L91 OR L92) AND L99
L106 45 SEA (L82 OR L91 OR L92) AND L100
L107 37 SEA L104 AND L106
L108 15290 SEA (L98 OR L99) AND (L101 OR L86 OR L42)
L109 1 SEA L108 AND L95
L110 119 SEA L108 AND (L49 OR L50 OR L51)
L111 3 SEA L110 AND (L95 OR L43 OR L44 OR L45 OR L47 OR L48)
L112 109 SEA L110 AND (L72 OR L73 OR L74)
L113 94 SEA L112 AND L101

L114 18 SEA L112 AND L86
L115 3 SEA L112 AND L42
L116 0 SEA L113 AND (L82 OR L91 OR L92)
L117 9 SEA L113 AND (?AMINO? OR ?AMINE?)
L118 29356 SEA AMIDAT?
L119 9 SEA L108 AND L118
L120 64 SEA L13 OR L27 OR L55 OR L57 OR L59 OR L60 OR L61 OR L62
OR L63 OR L64 OR L78 OR L81 OR L83 OR L84 OR L85 OR L90
OR L93 OR L94 OR L96 OR L97 OR L103 OR L105 OR L109 OR
L111 OR L115 OR L117 OR L119
L121 22 SEA (L79 OR L114) NOT L120
L122 26 SEA L82 NOT (L120 OR L121)
L123 47 SEA (L91 OR L92) NOT (L120 OR L121 OR L122)
L124 56 SEA L120 AND (1907-2001/PRY OR 1907-2001/PY)
L125 19 SEA L121 AND (1907-2001/PRY OR 1907-2001/PY)
L126 26 SEA L122 AND (1907-2001/PRY OR 1907-2001/PY)
L127 44 SEA L123 AND (1907-2001/PRY OR 1907-2001/PY).

=> file hca

FILE 'HCA' ENTERED AT 20:51:07 ON 24 JUN 2004

USE IS SUBJECT TO THE TERMS OF YOUR STN CUSTOMER AGREEMENT.

PLEASE SEE "HELP USAGETERMS" FOR DETAILS.

COPYRIGHT (C) 2004 AMERICAN CHEMICAL SOCIETY (ACS)

=> d l124 1-56 cbib abs hitstr hitind

L124 ANSWER 1 OF 56 HCA COPYRIGHT 2004 ACS on STN

139:136029 Heat-resistant polymer electrolyte and its manufacture.

Tsusaka, Kyoko; Hasegawa, Naoki; Kawakado, Masaya; Yamamoto, Takashi; Kamiya, Atsushi; Kawahara, Kazuo; Honda, Eiji; Takahashi, Yasushi (Toyota Central Research and Development Laboratories, Inc., Japan; Asahi Kasei Corporation; Toyota Motor Corp.). Jpn. Kokai Tokkyo Koho JP 2003208817 A2 20030725, 24 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2002-323490 20021107. PRIORITY: JP 2001-343861 20011108.

AB The electrolyte is manufd. by bringing a perfluoro electrolyte precursor into contact with a gas contg. **NH3** and/or primary amine and converting the precursor to proton type. Alternatively, the electrolyte has (1) a primary layer of a strongly acidic imido-contg. perfluoro polymer electrolyte and (2) a secondary layer of a perfluoropolymer electrolyte which has strongly acidic imido group in lower amt. than the primary layer or is free of the group on the primary layer surface. The electrolyte has high strength and ion cond. and is suitable for fuel cells, water electrolysis app., sensors, etc.

IT 7664-41-7, Ammonia, uses
(electrolyte precursor treated with; heat-resistant
imido-introduced polymer electrolyte and its manuf. from
perfluoro precursor)

RN 7664-41-7 HCA

CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH₃

IT 418770-63-5DP, Nafion 112F, reaction products with
ammonia and trimethylamine, sapond., protonated
474105-84-5DP, Nafion 111F, reaction products with
ammonia and trimethylamine, sapond., protonated
(heat-resistant imido-introduced polymer electrolyte and its
manuf. from perfluoro precursor)

RN 418770-63-5 HCA

CN Nafion 112F (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 474105-84-5 HCA

CN Nafion 111F (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC ICM H01B001-06

ICS C08F008-30; H01B013-00; H01M008-02; H01M008-10

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 38, 76

ST heat resistance polymer electrolyte fuel cell; ammonia
primary amine reaction perfluoro polymer electrolyte

IT 75-50-3, Trimethylamine, uses 102-69-2, Tri-n-propylamine
102-82-9, Tri-n-butylamine 7664-41-7,
Ammonia, uses 14130-07-5, 1-Tricosanamine
141563-84-0, AK 225

(electrolyte precursor treated with; heat-resistant
imido-introduced polymer electrolyte and its manuf. from
perfluoro precursor)

IT 418770-63-5DP, Nafion 112F, reaction products with
ammonia and trimethylamine, sapond., protonated
474105-84-5DP, Nafion 111F, reaction products with
ammonia and trimethylamine, sapond., protonated
565454-84-4DP, Aciplex S 1001F, reaction products with
ammonia and trimethylamine, sapond., protonated
(heat-resistant imido-introduced polymer electrolyte and its
manuf. from perfluoro precursor)

L124 ANSWER 2 OF 56 HCA COPYRIGHT 2004 ACS on STN

138:341111 Crosslinked polymer electrolyte compositions for
alkali metal polymer batteries. Le, Dinh Ba; Scanlan, Jerome E.;
Arudi, Ravindra L. (3M Innovative Properties Company, USA). PCT

Int. Appl. WO 2003036753 A2 20030501, 52 pp. DESIGNATED STATES: W:
 AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN,
 CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE,
 GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,
 LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO,
 NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN,
 TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, AM, AZ, BY, KG,
 RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR,
 GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR.
 (English). CODEN: PIXXD2. APPLICATION: WO 2002-US28003 20020903.
 PRIORITY: US 2001-37413 20011024.

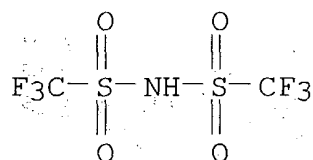
AB **Electrolyte** compns. are disclosed for use in cells and batteries that include a crosslinked **solid** ionically conductive **polymer** having urethane groups, urea groups, thiocarbamate groups, or combinations thereof, particles, and a salt. Certain **electrolyte** compns. include a liq. thereby forming a gel **electrolyte** compn.

IT 90076-65-6, Lithium bis(trifluoromethanesulfonyl)imide

(crosslinked polymer **electrolyte** compns. for alkali metal polymer batteries)

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

IC ICM H01M010-40

ICS H01B001-12; C08G018-22

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38

ST battery crosslinked polymer **electrolyte** compn.

IT Battery cathodes

Battery **electrolytes**

Coating process

Ionic conductivity

(crosslinked polymer **electrolyte** compns. for alkali metal polymer batteries)

IT **Polyamines**

- Polyoxyalkylenes, uses
(**crosslinked polymer electrolyte** compns. for alkali metal polymer batteries)
- IT Secondary batteries
(lithium; **crosslinked polymer electrolyte** compns. for alkali metal polymer batteries)
- IT **Amines, processes**
(tertiary; **crosslinked polymer electrolyte** compns. for alkali metal polymer batteries)
- IT 7631-86-9, Fumed Silica, uses
(colloidal; **crosslinked polymer electrolyte** compns. for alkali metal polymer batteries)
- IT 77-58-7, Dibutyltin dilaurate
(**crosslinked polymer electrolyte** compns. for alkali metal polymer batteries)
- IT 1344-28-1, Alumina, uses 9046-10-0, Jeffamine D-2000
24991-55-7, Polyethylene glycol dimethyl ether 90076-65-6,
Lithium bis(**trifluoromethanesulfonyl**)imide
106605-60-1, Lithium vanadiumoxide Li1.2V3O8
(**crosslinked polymer electrolyte** compns. for alkali metal polymer batteries)
- IT 518021-06-2P
(**crosslinked polymer electrolyte** compns. for alkali metal polymer batteries)
- IT 57534-41-5, Zonyl FSN 116243-07-3, Desmodur N 3200
(**crosslinked polymer electrolyte** compns. for alkali metal polymer batteries)
- IT 9003-07-0, Polypropylene
(liner; **crosslinked polymer electrolyte** compns. for alkali metal polymer batteries)
- IT 106392-12-5, Ethylene oxide-propylene oxide block copolymer
(triblock; **crosslinked polymer electrolyte** compns. for alkali metal polymer batteries)
- IT 7439-93-2DP, Lithium, complex with Desmodur N 3200-ethylene glycol-ethylene oxide copolymer 259099-94-ODP, lithium complex
518021-05-1DP, lithium complex
(**trifluoromethanesulfonylimide**-contg.; **crosslinked polymer electrolyte** compns. for alkali metal polymer batteries)

L124 ANSWER 3 OF 56 HCA COPYRIGHT 2004 ACS on STN

138:48156 **Polymer solid electrolytes.**

Aoki, Minoru; Ito, Masaji; Inaoka, Akira (Nippon Shokubai Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2002358822 A2 20021213, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-165244 20010531.

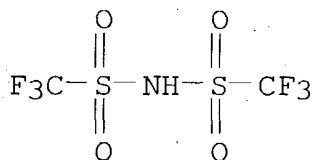
AB The title **electrolytes** contain **polyamine**-polyether polyol in which alkylene oxides are added to the NH-binding sites of polyalkylene imines which have branches. The

electrolytes have excellent ionic cond. and stability against metallic Li.

IT 90076-65-6, Lithium bistrifluoromethylsulfonylimide
(polymer solid electrolytes contg.
polyamine-polyether polyol)

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-,
lithium salt (9CI) (CA INDEX NAME)



● Li

IC ICM H01B001-06

ICS C08G073-04; H01M010-40

CC 76-3 (Electric Phenomena)

Section cross-reference(s): 52, 72

ST **polymer solid electrolyte**

polyamine polyether polyol; polyalkylene imine oxide
electrolyte

IT Semiconductor devices

(electrochromic; **polymer solid**

electrolytes contg. polyamine-polyether polyol)

IT **Amines, uses**

(ethoxylated; **polymer solid**

electrolytes contg. polyamine-polyether polyol)

IT Secondary batteries

(lithium; **polymer solid electrolytes**

contg. polyamine-polyether polyol for)

IT **Electrolytic capacitors**

Polymer electrolytes

(polymer solid electrolytes contg.

polyamine-polyether polyol)

IT Polyoxyalkylenes, uses

(polymer solid electrolytes contg.

polyamine-polyether polyol)

IT 75-21-8, Ethylene oxide, reactions 9002-98-6, Epomin SP 003

(polymer solid electrolytes contg.

polyamine-polyether polyol)

IT 90076-65-6, Lithium bistrifluoromethylsulfonylimide

(polymer solid electrolytes contg.)

polyamine-polyether polyol)

L124 ANSWER 4 OF 56 HCA COPYRIGHT 2004 ACS on STN

137:371122 Fluorosulfonic acid polymers for lithium batteries and direct methanol fuel cells and their manufacture. Yang, Zhen-Yu (E. I. Du Pont de Nemours & Co., USA). PCT Int. Appl. WO 2002092646 A1 20021121, 21 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US15604 20010514.

AB The compn. comprises a polymer having a fluorinated backbone and 3-20 mol% pendant groups $-Op[CF(Rf1)CFOm]nCF2CF2SO3X$ ($Rf = F$, C1-10 perfluoroalkyl (un)substituted by ≥ 1 ether oxygen atom; $m = 0, 1$; $n = 0-3$; $p = 0, 1$; $X = H$, alkali metal) and 0.5-40% siloxane comprising ≥ 2 groups $-OaSi(OH)b-aR13-bR2Rf2SO3X$ ($a = 1-b$; $b = 1-3$; $R1 =$ nonhydrolyzable group selected from alkyl, cycloalkyl, aryl and aralkyl; $X =$ alkali metal, H ; $R2 =$ alkylene (un)substituted by ≥ 1 ether oxygen atom; and $Rf2 =$ perfluoroalkylene ether (un)substituted by ≥ 1 ether oxygen atom). The shape articles formed from the compn. having high ionic cond. and improved barrier to methanol permeation are useful in lithium batteries and direct methanol fuel cells. Thus, methanol-treated 0.235 g Nation 151 films was immersed in 4.0 g $(CH3O)3SiCH2CH2CF2CF2OCF2CF2SO2F$ [prepd. from $ICF2CF2OCF2CF2SO2F$ and $(CH3O)3SiCH:CH2$] at 60° for 30 min., applied over the surface with 3 drops $CF3CO2H$ to give a film showing Cond. 0.055 S/cm.

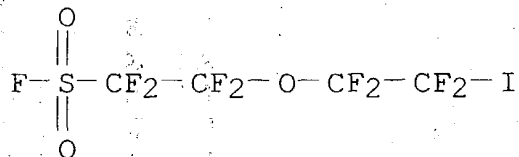
IT 66796-30-3DP, Nafion 117, reaction products with fluorinated ethanesulfonyl silane 162774-80-3DP, Nafion 105, reaction products with fluorinated ethanesulfonyl silane 264918-44-7DP, Nafion 151, reaction products with fluorinated ethanesulfonyl silane (film; prepn. of alkoxysilane-modified fluorosulfonic acid polymers for lithium batteries and direct methanol fuel cells)

RN 66796-30-3 HCA
CN Nafion 117 (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
RN 162774-80-3 HCA
CN Nafion 105 (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
RN 264918-44-7 HCA
CN Nafion 151 (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
IT 66137-74-4

(starting material; prepn. of alkoxy silane-modified fluorosulfonic acid polymers for lithium batteries and direct methanol fuel cells)

RN 66137-74-4 HCA

CN Ethanesulfonyl fluoride, 1,1,2,2-tetrafluoro-2-(1,1,2,2-tetrafluoro-2-iodoethoxy)- (9CI) (CA INDEX NAME)



IC ICM C08F008-42

ICS C08K005-5419; C08J005-22

CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 52

IT 66796-30-3DP, Nafion 117, reaction products with fluorinated ethanesulfonyl silane 162774-80-3DP, Nafion 105, reaction products with fluorinated ethanesulfonyl silane 264918-44-7DP, Nafion 151, reaction products with fluorinated ethanesulfonyl silane (film; prepn. of alkoxy silane-modified fluorosulfonic acid polymers for lithium batteries and direct methanol fuel cells)

IT 2768-02-7 66137-74-4

(starting material; prepn. of alkoxy silane-modified fluorosulfonic acid polymers for lithium batteries and direct methanol fuel cells)

L124 ANSWER 5 OF 56 HCA COPYRIGHT 2004 ACS on STN

137:371096 Manufacture of sulfo group-containing fluoropolymer membranes for fuel cells. Koga, Takehiro; Ikeda, Masanori (Asahi Kasei Corporation, Japan). Jpn. Kokai Tokkyo Koho JP 2002332366 A2 20021122, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-140331 20010510.

AB Membranes of polymers having RfSO₃H (Rf = C₁-4 perfluoroalkylene) in their side chains are manufd. by (1) treatment of RfSO₂F (Rf = same as above)-contg. polymers with amines in the presence of H₂O, (2) melt film formation, and (3) treatment with acids. Thus, (CF₂CF₂)_k[CF₂CF[OCF₂CF(CF₃)OCF₂CF₂SO₂F]]_l was treated with Et₂NH, hot-pressed, and treated with H₂SO₄ to give a SO₃H-contg. film showing good dimensional stability.

IT 26654-97-7DP, reaction products with amines, hydrolyzates 69462-70-0DP, reaction products with amines, hydrolyzates (manuf. of sulfo group-contg. fluoropolymer membranes for fuel cells)

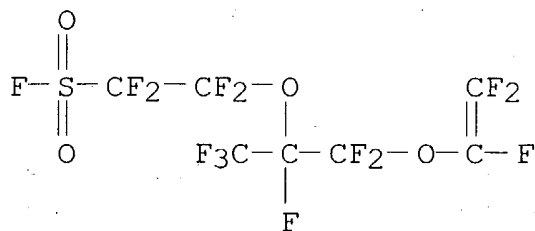
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



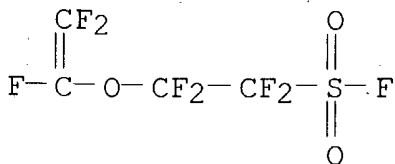
RN 69462-70-0 HCA

CN Ethanesulfonyl fluoride, 1,1,2,2-tetrafluoro-2-[(trifluoroethenyl)oxy]-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 29514-94-1

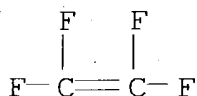
CMF C4 F8 O3 S



CM 2

CRN 116-14-3

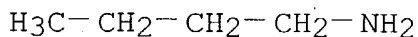
CMF C2 F4



IT 109-73-9, n-Butylamine, reactions 7664-41-7,
 Ammonia, reactions
 (manuf. of sulfo group-contg. fluoropolymer membranes for
fuel cells)

RN 109-73-9 HCA

CN 1-Butanamine (9CI) (CA INDEX NAME)



RN 7664-41-7 HCA

CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH₃

IC ICM C08J007-14

ICS C08F008-26; C08L027-12

CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 52

ST sulfo fluoropolymer membrane manuf **fuel cell**;sulfonyl fluoride fluoropolymer **amine acid****treatment**IT **Fuel cell** separators

Membranes, nonbiological

(manuf. of sulfo group-contg. fluoropolymer membranes for
fuel cells)

IT Amines, reactions

(manuf. of sulfo group-contg. fluoropolymer membranes for
fuel cells)

IT Polymer electrolytes

(membranes; manuf. of sulfo group-contg. fluoropolymer membranes
for **fuel cells**)

IT Fluoropolymers, uses

(sulfo-contg.; manuf. of sulfo group-contg. fluoropolymer
membranes for **fuel cells**)

IT 26654-97-7DP, reaction products with amines, hydrolyzates

69462-70-ODP, reaction products with amines, hydrolyzates

214690-34-3DP, reaction products with amines, hydrolyzates

(manuf. of sulfo group-contg. fluoropolymer membranes for
fuel cells)

IT 109-73-9, n-Butylamine, reactions 109-89-7, Diethylamine,
reactions 121-44-8, Triethylamine, reactions 7664-41-7,
Ammonia, reactions
(manuf. of sulfo group-contg. fluoropolymer membranes for
fuel cells)

L124 ANSWER 6 OF 56 HCA COPYRIGHT 2004 ACS on STN

137:340001 Process for producing a modified **electrolyte** for
electrochemical devices. Tanaka, Hiromitsu; Usuki,
Arimitsu; Kawasumi, Masaya; Morimoto, Yu; Hasegawa, Naoki; Nakano,
Mitsuru; Kamiya, Atsushi (Kabushiki Kaisha Toyota Chuo, Japan).
U.S. Pat. Appl. Publ. US 2002160272 A1 20021031, 29 pp. (English).
CODEN: USXXCO. APPLICATION: US 2002-79873 20020222. PRIORITY: JP
2001-47634 20010223.

AB A first process for producing a modified **electrolyte**
consistent with the present invention comprises an **amine**
treatment step of contacting a **solid**
polymer electrolyte or a precursor thereof with an
amine compd. Further, a first modified **electrolyte**
consistent with the present invention consists essentially of what
is obtained in such a process. A second process for producing the
modified **electrolyte** consistent with the present invention
includes a step of introducing, to a **solid polymer**
compd. having a functional group A, a first modifying agent
comprising at least one functional group B capable of reacting with
the functional group A thereby forming a first intermediate acid
group; and the step also includes reacting the functional group A
and the functional group B. Further, a second modified
electrolyte consistent with the present invention comprises
a **solid polymer** compd. having side chains, at
least one terminal acid group present at terminals of the side
chains, and at least one intermediate acid group and/or reformed
acid group present within the side chains identical with the side
chains contg. the terminal acid group.

IT 9002-84-0, Ptfe
(perfluoro **electrolyte** membrane reinforced with;
process for producing modified **electrolyte** for
electrochem. devices)

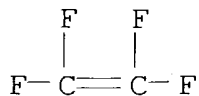
RN 9002-84-0 HCA

CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

CMF C2 F4

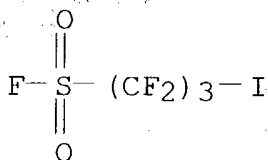


IT 146829-76-7

(polymer electrolyte treated with; process for
producing modified electrolyte for electrochem
devices)

RN 146829-76-7 HCA

CN 1-Propanesulfonyl fluoride, 1,1,2,2,3,3-hexafluoro-3-iodo- (9CI)
(CA INDEX NAME)

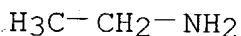


IT 75-04-7D, Ethylamine, alkali metal compd. 107-10-8
, Propylamine, processes 109-73-9,
Butylamine, processes 335-01-3,
Perfluoromethylamine 7664-41-7, Ammonia,
processes 82727-16-0

(polymer electrolyte treated with; process
for producing modified electrolyte for
electrochem. devices)

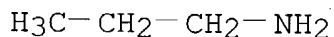
RN 75-04-7 HCA

CN Ethanamine (9CI) (CA INDEX NAME)



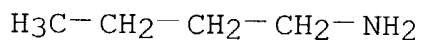
RN 107-10-8 HCA

CN 1-Propanamine (9CI) (CA INDEX NAME)



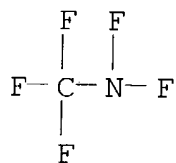
RN 109-73-9 HCA

CN 1-Butanamine (9CI) (CA INDEX NAME)



RN 335-01-3 HCA

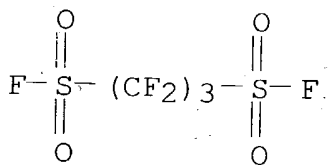
CN Methanamine, pentafluoro- (9CI) (CA INDEX NAME)



RN 7664-41-7 HCA
 CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH₃

RN 82727-16-0 HCA
 CN 1,3-Propanedisulfonyl difluoride, 1,1,2,2,3,3-hexafluoro- (9CI) (CA INDEX NAME)



IT 197895-58-2D, Ethylene-styrene-tetrafluoroethylene graft copolymer, amidized 418770-63-5, Nafion

112f 474105-84-5, Nafion 111F

(process for producing modified electrolyte for electrochem. devices)

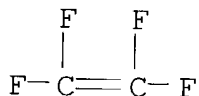
RN 197895-58-2 HCA

CN Benzene, ethenyl-, polymer with ethene and tetrafluoroethene, graft (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

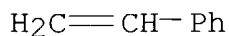
CMF C2 F4



CM 2

CRN 100-42-5

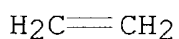
CMF C8 H8



CM 3

CRN 74-85-1

CMF C2 H4



RN 418770-63-5 HCA

CN Nafion 112F (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 474105-84-5 HCA

CN Nafion 111F (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 474100-51-1P 474100-53-3P 474100-56-6P

474100-59-9P

(process for producing modified electrolyte for
electrochem. devices)

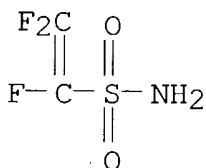
RN 474100-51-1 HCA

CN Ethenesulfonamide, 1,2,2-trifluoro-, polymer with tetrafluoroethene
(9CI) (CA INDEX NAME)

CM 1

CRN 474100-50-0

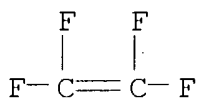
CMF C2 H2 F3 N O2 S



CM 2

CRN 116-14-3

CMF C2 F4



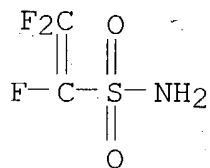
RN 474100-53-3 HCA

CN 1,3-Propanedisulfonyl dichloride, 1,1,2,2,3,3-hexafluoro-, polymer
with tetrafluoroethene and 1,2,2-trifluoroethenesulfonamide (9CI)
(CA INDEX NAME)

CM 1

CRN 474100-50-0

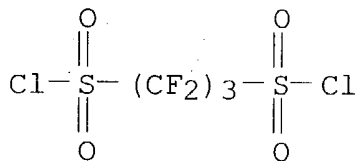
CMF C2 H2 F3 N O2 S



CM 2

CRN 146829-75-6

CMF C3 Cl2 F6 O4 S2



CM 3

CRN 116-14-3

CMF C2 F4



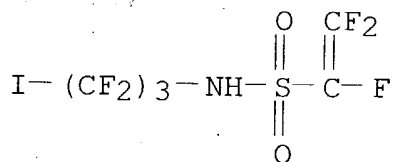
RN 474100-56-6 HCA

CN Ethenesulfonamide, 1,2,2-trifluoro-N-(1,1,2,2,3,3-hexafluoro-3-iodopropyl)-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 474100-55-5

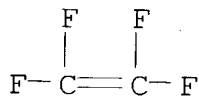
CMF C5 H F9 I N O2 S



CM 2

CRN 116-14-3

CMF C2 F4



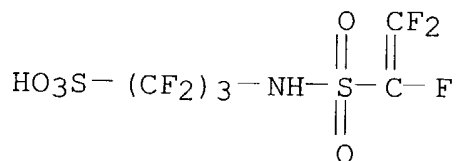
RN 474100-59-9 HCA

CN 1-Propanesulfonic acid, 1,1,2,2,3,3-hexafluoro-3-[[trifluoroethenyl)sulfonyl]amino]-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 474100-58-8

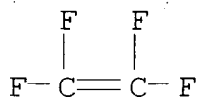
CMF C5 H2 F9 N O5 S2



CM 2

CRN 116-14-3

CMF C2 F4



- IC ICM H01M008-10
ICS H01M010-40
- NCL 429314000
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 38, 72, 76
- ST **fuel cell** modified **electrolyte** prepn;
electrolyzer modified **electrolyte** prepn; sensor
modified **electrolyte** prepn
- IT Creep
(elongation; process for producing modified **electrolyte**
for **electrochem.** devices)
- IT Polyoxyalkylenes, uses
(fluorine- and sulfo-contg., ionomers; process for producing
modified **electrolyte** for **electrochem.**
devices)
- IT Polyimides, uses
(membranes; process for producing modified **electrolyte**
for **electrochem.** devices)
- IT Fluoropolymers, uses
(perfluoro **electrolyte** membrane reinforced with;
process for producing modified **electrolyte** for
electrochem. devices)
- IT **Amines, processes**
(polymer **electrolyte** treated with; process for
producing modified **electrolyte** for **electrochem.**
devices)
- IT Fluoropolymers, uses
(polyoxyalkylene-, sulfo-contg., ionomers; process for producing
modified **electrolyte** for **electrochem.**
devices)
- IT Ionomers
(polyoxyalkylenes, fluorine- and sulfo-contg.; process for
producing modified **electrolyte** for **electrochem.**
devices)
- IT **Amidation**
Electric conductivity
Electrolytes
Electrolytic cells
Fuel cell electrolytes
Heat treatment
Polymer **electrolytes**
Sensors

- (process for producing modified **electrolyte** for **electrochem.** devices)
- IT Fluoropolymers, uses
(process for producing modified **electrolyte** for **electrochem.** devices)
- IT Metal alkoxides
(sodium, polymer **electrolyte** treated with; process for producing modified **electrolyte** for **electrochem.** devices)
- IT Fuel cells
(solid **electrolyte**; process for producing modified **electrolyte** for **electrochem.** devices)
- IT 474100-64-6
(perfluoro **electrolyte** membrane reinforced with; process for producing modified **electrolyte** for **electrochem.** devices)
- IT 9002-84-0, Ptfе
(perfluoro **electrolyte** membrane reinforced with; process for producing modified **electrolyte** for **electrochem.** devices)
- IT 146829-76-7
(polymer **electrolyte** treated with; process for producing modified **electrolyte** for **electrochem.** devices)
- IT 75-04-7D, Ethylamine, alkali metal compd. 75-50-3, Trimethylamine, processes 107-10-8, Propylamine, processes 109-72-8, Butyl lithium, processes 109-73-9, Butylamine, processes 110-58-7, Pentylamine 110-86-1, Pyridine, processes 111-26-2, 1-Hexylamine 111-68-2, Heptylamine 112-20-9, Nonylamine 121-44-8, Triethylamine, processes 144-55-8, Sodium bicarbonate, processes 335-01-3, Perfluoromethylamine 423-32-5 497-19-8, Sodium carbonate, processes 584-08-7, Potassium carbonate 591-51-5, Phenyl lithium 812-47-5, Perfluorobutylamine 999-97-3D, Silanamine, 1,1,1-trimethyl-N-(trimethylsilyl)-, alkali metal compd. 1305-62-0, Calcium hydroxide, processes 1310-58-3, Potassium hydroxide, processes 1310-65-2, Lithium hydroxide 1310-73-2, Sodium hydroxide, processes 2016-57-1, Decylamine 3001-72-7, 1,5-Diazabicyclo[4.3.0]non-5=ene 4039-32-1, Lithium bis(trimethylsilyl)amide 4984-82-1, Sodium cyclopentadienide 6674-22-2, Dbu 7646-69-7, Sodium hydride 7664-41-7, Ammonia, processes 7693-26-7, Potassium hydride 7782-92-5, Sodium amide 7789-78-8, Calcium hydride 16940-66-2, Sodium borohydride 21645-51-2, Aluminum hydroxide, processes 82727-16-0 134380-80-6 262437-80-9, Aluminum lithium hydride 474100-48-6

- (polymer electrolyte treated with; process for producing modified electrolyte for electrochem. devices)
- IT 197895-58-2D, Ethylene-styrene-tetrafluoroethylene graft copolymer, amidized 418770-63-5, Nafion 112f 474105-84-5, Nafion 111F
(process for producing modified electrolyte for electrochem. devices)
- IT 177601-69-3DP, amidized 177601-70-6DP, amidized 196309-83-8DP, amidized 302924-87-4DP, amidized
(process for producing modified electrolyte for electrochem. devices)
- IT 31694-16-3, Peek
(process for producing modified electrolyte for electrochem. devices)
- IT 474100-51-1P 474100-53-3P 474100-56-6P 474100-59-9P
(process for producing modified electrolyte for electrochem. devices)
- IT 76-13-1, R113 109-99-9, Thf, uses
(solvent; process for producing modified electrolyte for electrochem. devices)

L124 ANSWER 7 OF 56 HCA COPYRIGHT 2004 ACS on STN

137:169968 Manufacture of perfluorovinyl ether monomer having sulfonamide group and its use for solid electrolyte membrane. Ikeda, Masanori; Hoshi, Nobuto; Uematsu, Nobuyuki; Koga, Takehiro (Asahi Kasei Kabushiki Kaisha, Japan). PCT Int. Appl. WO 2002062749 A1 20020815, 215 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (Japanese). CODEN: PIXXD2. APPLICATION: WO 2002-JP854 20020201. PRIORITY: JP 2001-25018 20010201; JP 2001-30955 20010207; JP 2001-278418 20010913; JP 2001-342172 20011107; JP 2001-343780 20011108; JP 2001-343931 20011108.

AB A perfluorovinyl ether monomer represented by $\text{CF}_2\text{CF}(\text{OCF}_2\text{CFCF}_3)_m\text{O}(\text{CF}_2)_n\text{SO}_2\text{NR}_1\text{R}_2$ (wherein $m = 0-5$ integer; $n = 1-5$ integer; $\text{R}_1, \text{R}_2 = \text{H}, \text{C}_1-10$ (un)substituted hydrocarbyl, substituted silyl; R_1 and R_2 may be bonded to each other to form a ring) and its polymers are prep'd. and the polymer films are used as solid electrolyte membrane. Neutralization of $\text{CF}_3\text{CF}(\text{COF})\text{OCF}_2\text{CF}_2\text{SO}_3\text{F}$ with Na_2CO_3 , amidation with

diethylamine and n-BuLi, and decarboxylation gave CF₂:CFOCF₂CF₂SO₃NEt₂. Copolymn. of this monomer with tetrafluoroethylene and press molding at 250° gave a membrane useful for solid **electrolyte**.

IT 445293-58-3P

(manuf. of perfluorovinyl ether monomer having sulfonamide group for prepn. of solid **electrolyte** membrane)

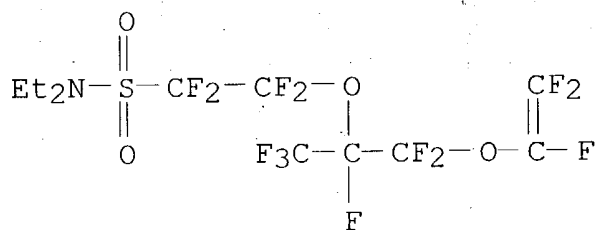
RN 445293-58-3 HCA

CN Ethanesulfonamide, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-N,N-diethyl-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 445293-57-2

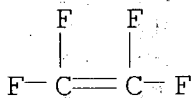
CMF C11 H10 F13 N O4 S



CM 2

CRN 116-14-3

CMF C2 F4



IT 445293-62-9P 446312-64-7P 446312-66-9P

446312-67-0DP, bis(sulfonimide) derivs. 446312-67-0P

446312-73-8P 446312-74-9P

(manuf. of perfluorovinyl ether monomer having sulfonamide group for prepn. of solid **electrolyte** membrane)

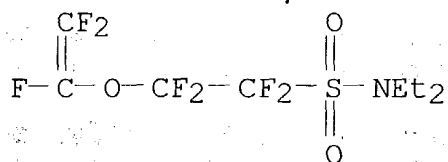
RN 445293-62-9 HCA

CN Ethanesulfonamide, N,N-diethyl-1,1,2,2-tetrafluoro-2-[(trifluoroethenyl)oxy]-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 445293-61-8

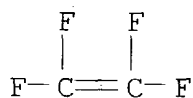
CMF C8 H10 F7 N O3 S



CM 2

CRN 116-14-3

CMF C2 F4



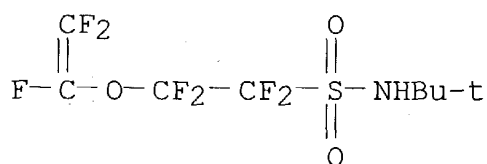
RN 446312-64-7 HCA

CN Ethanesulfonamide, N-(1,1-dimethylethyl)-1,1,2,2-tetrafluoro-2-
[(trifluoroethenyl)oxy]-, polymer with tetrafluoroethene (9CI) (CA
INDEX NAME)

CM 1

CRN 446312-54-5

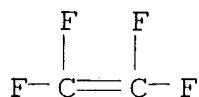
CMF C8 H10 F7 N O3 S



CM 2

CRN 116-14-3

CMF C2 F4



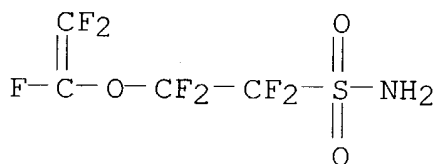
RN 446312-66-9 HCA

CN Ethanesulfonamide, 1,1,2,2-tetrafluoro-2-[(trifluoroethenyl)oxy]-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 446312-65-8

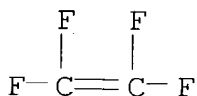
CMF C4 H2 F7 N O3 S



CM 2

CRN 116-14-3

CMF C2 F4



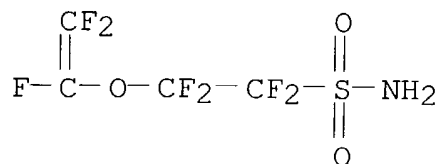
RN 446312-67-0 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene and 1,1,2,2-tetrafluoro-2-[(trifluoroethenyl)oxy]ethanesulfonamide (9CI) (CA INDEX NAME)

CM 1

CRN 446312-65-8

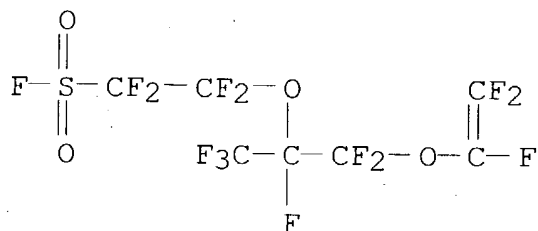
CMF C4 H2 F7 N O3 S



CM 2

CRN 16090-14-5

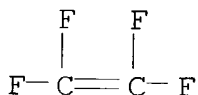
CMF C7 F14 O4 S



CM 3

CRN 116-14-3

CMF C2 F4



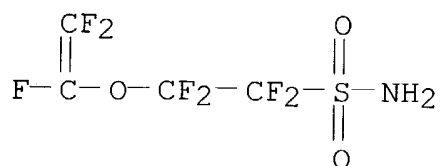
RN 446312-67-0 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene and 1,1,2,2-tetrafluoro-2-[(trifluoroethenyl)oxy]ethanesulfonamide (9CI) (CA INDEX NAME)

CM 1

CRN 446312-65-8

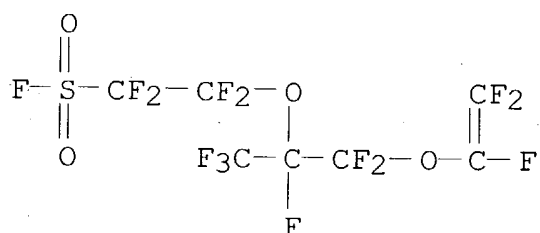
CMF C4 H2 F7 N O3 S



CM 2

CRN 16090-14-5

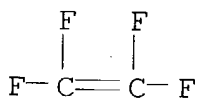
CMF C7 F14 O4 S



CM 3

CRN 116-14-3

CMF C2 F4



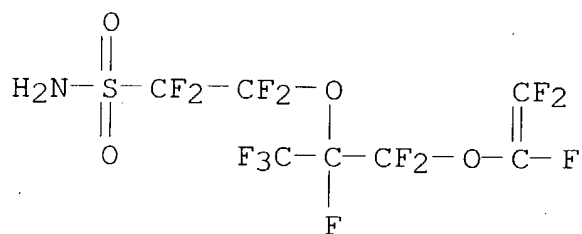
RN 446312-73-8 HCA

CN Ethanesulfonamide, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 446312-71-6

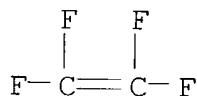
CMF C7 H2 F13 N O4 S



CM 2

CRN 116-14-3

CMF C2 F4



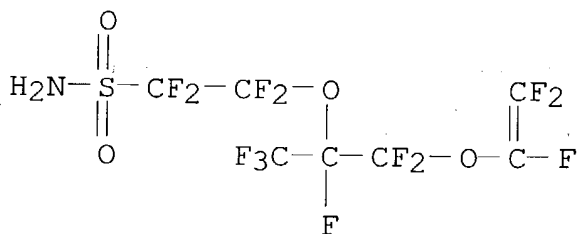
RN 446312-74-9 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoroethanesulfonamide and tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 446312-71-6

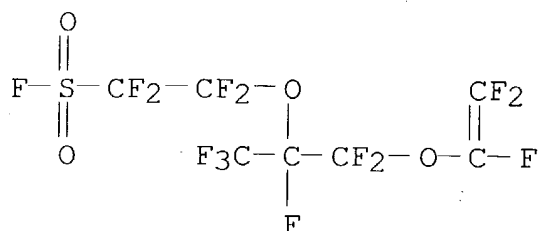
CMF C7 H2 F13 N O4 S



CM 2

CRN 16090-14-5

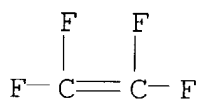
CMF C7 F14 O4 S



CM 3

CRN 116-14-3

CMF C2 F4



- IC ICM C07C311-24
ICS C07C303-36; C07F007-12; C08F214-26; C08F216-14; H01M008-02
- CC 35-2 (Chemistry of Synthetic High Polymers)
Section cross-reference(s): 38, 52
- ST perfluorovinyl ether monomer sulfonamide group; solid **electrolyte** perfluorovinyl ether tetrafluoroethylene copolymer membrane
- IT Ethers, preparation
(fluoroalkyl; manuf. of perfluorovinyl ether monomer having sulfonamide group for prepn. of solid **electrolyte** membrane)
- IT Solid **electrolytes**
(manuf. of perfluorovinyl ether monomer having sulfonamide group for prepn. of solid **electrolyte** membrane)
- IT Monomers
(manuf. of perfluorovinyl ether monomer having sulfonamide group for prepn. of solid **electrolyte** membrane)
- IT Fluoropolymers, preparation
(manuf. of perfluorovinyl ether monomer having sulfonamide group for prepn. of solid **electrolyte** membrane)
- IT Amines, reactions
(manuf. of perfluorovinyl ether monomer having sulfonamide group for prepn. of solid **electrolyte** membrane)
- IT 446312-50-1P 446312-60-3P
(manuf. of perfluorovinyl ether monomer having sulfonamide group for prepn. of solid **electrolyte** membrane)
- IT 75549-02-9P 75718-06-8P 78010-39-6P 144728-59-6P
445293-56-1P 445293-57-2P **445293-58-3P** 445293-59-4P

445293-60-7P 445293-61-8P 446312-49-8P 446312-51-2P
446312-52-3P 446312-53-4P 446312-54-5P 446312-55-6P
446312-56-7P 446312-57-8P 446312-58-9P 446312-59-0P
446312-61-4P 446312-62-5P 446312-63-6P 446312-65-8P
446312-68-1P 446312-69-2P 446312-70-5P 446312-71-6P
446312-72-7P 446312-75-0P

(manuf. of perfluorovinyl ether monomer having sulfonamide group
for prepn. of solid **electrolyte** membrane)

IT 445293-62-9P 446312-64-7P 446312-66-9P
446312-67-0DP, bis(sulfonimide) derivs. 446312-67-0P
446312-73-8P 446312-74-9P

(manuf. of perfluorovinyl ether monomer having sulfonamide group
for prepn. of solid **electrolyte** membrane)

IT 62-53-3, Aniline, reactions 75-64-9, tert-Butylamine, reactions
109-89-7, Diethylamine, reactions 109-97-7, Pyrrole 124-40-3,
Dimethylamine, reactions 288-32-4, Imidazole, reactions
999-97-3, Hexamethyldisilazane 1070-89-9, Sodium
hexamethyldisilazide 4089-57-0 4089-58-1 29514-94-1
77545-08-5

(manuf. of perfluorovinyl ether monomer having sulfonamide group
for prepn. of solid **electrolyte** membrane)

L124 ANSWER 8 OF 56 HCA COPYRIGHT 2004 ACS on STN

136:343296 Solid polymer electrolyte. Hasegawa, Naoki; Taniguchi,
Takumi; Kamiya, Atsushi; Kawakado, Masaya; Morimoto, Tomo (Toyota
Central Research and Development Laboratories, Inc., Japan). Jpn.
Kokai Tokkyo Koho JP 2002124272 A2 20020426, 9 pp. (Japanese).
CODEN: JKXXAF. APPLICATION: JP 2000-315996 20001017.

AB The electrolyte is a polymer electrolyte heat treated at
T±50° T = crystal m.p. or softening point of the
electrolyte, during or after electron beam or radiation treatment.

IT 418770-63-5, Nafion 112F
(heat and electron beam and radiation treatment of polymer
electrolyte membranes for fuel cells and electrochem. devices)

RN 418770-63-5 HCA

CN Nafion 112F (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC ICM H01M008-02

ICS C08J003-28; G01N027-416; G01N027-406; H01B001-06; H01M008-10;
C08L101-00

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 72

IT 24937-79-9, Poly(vinylidene fluoride) 31694-16-3D, Peek,
sulfonated 163294-14-2, Nafion 112 417702-20-6D,
perfluoroalkylsulfonic acid ethers derivs., polymers
418770-63-5, Nafion 112F

(heat and electron beam and radiation treatment of polymer
electrolyte membranes for fuel cells and electrochem. devices)

L124 ANSWER 9 OF 56 HCA COPYRIGHT 2004 ACS on STN

135:379519 Modified solid polymer electrolytes with improved heat resistance and durability and method for their modification.

Tanaka, Hiromitsu; Usuki, Arimitsu; Kawakado, Masaya; Morimoto, Tomo (Toyota Central Research and Development Laboratories, Inc., Japan).

Jpn. Kokai Tokkyo Koho JP 2001319521 A2 20011116, 11 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-135545 20000509.

AB The method contains contacting perfluoropolymer electrolytes or their precursors with amines. The electrolytes may be heated or treated with bases after the **amine treatment**.

The process offers polymer electrolytes showing high heat resistance and good durability without sacrificing the elec. cond.

IT 374064-22-9, Nafion F 112

(**amine treatment** of solid perfluoropolymer electrolytes with improved heat resistance and durability)

RN 374064-22-9 HCA

CN Nafion F 112 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 7664-41-7, Ammonia, reactions

(**amine treatment** of solid perfluoropolymer electrolytes with improved heat resistance and durability)

RN 7664-41-7 HCA

CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH3

IC ICM H01B001-06

ICS C08J003-24; G01N027-406; H01M008-02; C08L027-22

CC 76-2 (Electric Phenomena)

Section cross-reference(s): 38, 52

ST solid polymer electrolyte **modification amine**

treatment; base treatment fluoropolymer membrane heat resistance; heating perfluoropolymer lithium methylsilylamide fuel cell

IT Fuel cell electrolytes

Polymer electrolytes

(**amine treatment** of solid perfluoropolymer electrolytes with improved heat resistance and durability)

IT Fluoropolymers, **processes**

(**amine treatment** of solid perfluoropolymer electrolytes with improved heat resistance and durability)

IT **Amines**, reactions

(**amine treatment** of solid perfluoropolymer electrolytes with improved heat resistance and durability)

IT Polyoxyalkylenes, **processes**

(fluorine- and sulfo-contg., ionomers; **amine**

treatment of solid perfluoropolymer electrolytes with improved heat resistance and durability)

IT Fluoropolymers, processes

(polyoxyalkylene-, sulfo-contg., ionomers; amine treatment of solid perfluoropolymer electrolytes with improved heat resistance and durability)

IT Ionomers

(polyoxyalkylenes, fluorine- and sulfo-contg.; amine treatment of solid perfluoropolymer electrolytes with improved heat resistance and durability)

IT 374064-22-9, Nafion F 112

(amine treatment of solid perfluoropolymer electrolytes with improved heat resistance and durability)

IT 121-44-8, Triethylamine, reactions 4039-32-1, Lithium

bis(trimethylsilyl)amide 7664-41-7, Ammonia,

reactions 7782-92-5, Sodium amide

(amine treatment of solid perfluoropolymer electrolytes with improved heat resistance and durability)

L124 ANSWER 10 OF 56 HCA COPYRIGHT 2004 ACS on STN

135:143891 An electrochemical and XPS study of Ag-Pb binary alloys

incorporated in Nafion coatings. Casella, I. G.

(Dipartimento di Chimica, Universita' degli Studi della Basilicata, Potenza, 85100, Italy). Journal of Applied Electrochemistry, 31(4), 481-488 (English) 2001. CODEN: JAELEBJ. ISSN: 0021-891X.

Publisher: Kluwer Academic Publishers.

AB Glassy carbon electrodes coated with thin films of Nafion

metalized with silver and lead species were investigated by cyclic voltammetry, chronoamperometry and XPS (XPS). Metalization of Nafion film was accomplished by dipping the coated

electrodes in 3 mM AgNO₃ + 3 mM Pb(NO₃)₂ soln. for 10 min. The resulting chem. modified electrodes were electrochem. characterized toward the oxidn. of amino compds. in carbonate solns. buffered at pH 10. Under chronoamperometric expts. carried out at a const.

applied potential of 0.95 V vs SCE, the linear range ($r^2 > 0.995$) was detd. to be at least three decades and the limit of detection range from 26 μ M (ethylamine) and 65 μ M (tert-butylamine), for

the investigated amino compds. The perm-selective properties of the Nafion film with respect to anion species were investigated

toward the electrooxidn. of ethylamine in presence of large concn. of chloride ions. The XPS anal. revealed heterogeneous distribution

of the catalytic species dispersed in the metalized Nafion

film. Thus, a comparison of the spectra of Ag3d and Pb4f acquired at various take-off angles, indicates an increase in the at. ratio Ag:Pb and a notable enrichment of lead oxide species in the outer surface of the film when compared with the bulk membrane coated electrode.

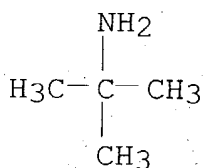
IT 75-64-9, tert-Butylamine, reactions 109-73-9,

1-Butylamine, reactions 7664-41-7, Ammonia,
reactions

(chronoamperometry of **Nafion**/silver-lead electrode in
Na₂CO₃-NaHCO₃ soln. contg.)

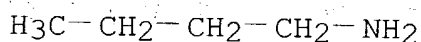
RN 75-64-9 HCA

CN 2-Propanamine, 2-methyl- (9CI) (CA INDEX NAME)



RN 109-73-9 HCA

CN 1-Butanamine (9CI) (CA INDEX NAME)



RN 7664-41-7 HCA

CN Ammonia (8CI, 9CI) (CA INDEX NAME)

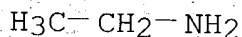


IT 75-04-7, Ethylamine, reactions

(cyclic voltammetry of **Nafion**/silver-lead electrode in
Na₂CO₃-NaHCO₃ soln. contg. ethylamine)

RN 75-04-7 HCA

CN Ethanamine (9CI) (CA INDEX NAME)



IT 66796-30-3, **Nafion** 117

(electrochem. and XPS study of Ag-Pb binary alloys incorporated
in **Nafion** coatings)

RN 66796-30-3 HCA

CN **Nafion** 117 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 72-8 (Electrochemistry)

Section cross-reference(s): 23, 56

ST lead silver alloy deposition **Nafion** coating glassy carbon
XPS

IT Electrodeposition

(of Ag-Pb binary alloys in **Nafion** coatings on glassy
carbon electrode)

- IT X-ray photoelectron spectra
(of **Nafion**/silver-lead electrode in Na₂CO₃-NaHCO₃ soln.)
- IT Chronoamperometry
Cyclic voltammetry
(of **Nafion**/silver-lead electrode in Na₂CO₃-NaHCO₃ soln. contg. ethylamine)
- IT Oxidation, electrochemical
(of ethylamine on **Nafion**/silver-lead electrode in Na₂CO₃-NaHCO₃ soln. in presence of chloride ions)
- IT 7761-88-8, Silver nitrate, reactions 10099-74-8, Lead nitrate
(Ag-Pb binary alloys incorporating into **Nafion** coatings on glassy carbon in soln. contg.)
- IT 75-50-3, Trimethylamine, reactions 75-64-9, tert-Butylamine, reactions 109-73-9, 1-Butylamine, reactions 109-89-7, Diethylamine, reactions 110-60-1, Putrescine 124-20-9, Spermidine 7664-41-7, Ammonia, reactions
(chronoamperometry of **Nafion**/silver-lead electrode in Na₂CO₃-NaHCO₃ soln. contg.)
- IT 144-55-8, Sodium bicarbonate, uses 497-19-8, Sodium carbonate, uses
(cyclic voltammetry of **Nafion**/silver-lead electrode in Na₂CO₃-NaHCO₃ soln. contg. ethylamine)
- IT 75-04-7, Ethylamine, reactions
(cyclic voltammetry of **Nafion**/silver-lead electrode in Na₂CO₃-NaHCO₃ soln. contg. ethylamine)
- IT 66796-30-3, **Nafion** 117
(electrochem. and XPS study of Ag-Pb binary alloys incorporated in **Nafion** coatings)
- IT 12798-70-8P
(electrochem. and XPS study of Ag-Pb binary alloys incorporated in **Nafion** coatings)
- IT 16887-00-6, Chloride, uses
(electrooxidn. of ethylamine on **Nafion**/silver-lead electrode in Na₂CO₃-NaHCO₃ soln. in presence of chloride ions)

L124 ANSWER 11 OF 56 HCA COPYRIGHT 2004 ACS on STN

135:20527 Relationship between ionic conductivity of perfluorinated ionomeric membranes and nonaqueous solvent properties. Doyle, M.; Lewittes, M. E.; Roelofs, M. G.; Perusich, S. A.; Lowrey, R. E. (DuPont Technologies, Wilmington, DE, 19880-0024, USA). Journal of Membrane Science, 184(2), 257-273 (English) 2001. CODEN: JMESDO. ISSN: 0376-7388. Publisher: Elsevier Science B.V..

AB Ionic cond. and swelling data are measured for **Nafion** perfluorinated ionomeric membranes in nonaq. solvents and solvent mixts. and correlated with solvent phys. properties. The dependence of ionic cond. on solvent uptake and cation type is examd. for

Nafion 117 membranes with a nominal equiv. wt. of 1100 g/equiv. The most important factors detg. ionic cond. in membranes swollen with polar nonaq. solvents are the solvent viscosity, molar volume, donor properties, and the solvent uptake by the membrane. Ionic cond. is generally limited by dissocn. of the cation from the fixed anion site indicating that the ionomer fixed anion site basicity is the crit. membrane property. Means for increasing membrane ionic cond. are discussed.

IT 66796-30-3, **Nafion** 117 77950-55-1,

Nafion 115

(ionic cond. of perfluorinated ionomeric membranes and nonaq. solvent properties)

RN 66796-30-3 HCA

CN **Nafion** 117 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 77950-55-1 HCA

CN **Nafion** 115 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 66796-30-3, **Nafion** 117

(ionic cond. of perfluorinated ionomeric membranes and nonaq. solvent properties)

RN 66796-30-3 HCA

CN **Nafion** 117 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 7664-41-7, **Ammonia**, reactions

(ionic cond. of perfluorinated ionomeric membranes exchanged with)

RN 7664-41-7 HCA

CN **Ammonia** (8CI, 9CI) (CA INDEX NAME)

NH₃

IT 109-73-9, **Butylamine**, uses

(solvent; ionic cond. of perfluorinated ionomeric membranes in)

RN 109-73-9 HCA

CN 1-Butanamine (9CI) (CA INDEX NAME)

H₃C-CH₂-CH₂-CH₂-NH₂

CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 52

IT Polyoxyalkylenes, uses

(fluorine- and sulfo-contg., ionomers, **Nafion**; ionic

cond. of perfluorinated ionomeric membranes and nonaq. solvent properties)

IT Fluoropolymers, uses

(polyoxyalkylene-, sulfo-contg., ionomers, **Nafion**;
ionic cond. of perfluorinated ionomeric membranes and nonaq.
solvent properties)

IT Ionomers

(polyoxyalkylenes, fluorine- and sulfo-contg., **Nafion**;
ionic cond. of perfluorinated ionomeric membranes and nonaq.
solvent properties)

IT 66796-30-3, **Nafion** 117 77950-55-1,
Nafion 115

(ionic cond. of perfluorinated ionomeric membranes and nonaq.
solvent properties)

IT 66796-30-3, **Nafion** 117

(ionic cond. of perfluorinated ionomeric membranes and nonaq.
solvent properties)

IT 7439-89-6, Iron, reactions 7439-93-2, Lithium, reactions
7439-95-4, Magnesium, reactions 7440-02-0, Nickel, reactions
7440-09-7, Potassium, reactions 7440-17-7, Rubidium, reactions
7440-22-4, Silver, reactions 7440-23-5, Sodium, reactions
7440-24-6, Strontium, reactions 7440-39-3, Barium, reactions
7440-46-2, Cesium, reactions 7440-50-8, Copper, reactions
7440-66-6, Zinc, reactions 7440-70-2, Calcium, reactions
7664-41-7, **Ammonia**, reactions

(ionic cond. of perfluorinated ionomeric membranes exchanged
with)

IT 67-56-1, Methanol, uses 67-64-1, Acetone, uses 67-68-5, DMSO,
uses 68-12-2, DMF, uses 78-40-0, Triethyl phosphate 96-35-5,
Methyl glycolate 96-48-0, γ -Butyrolactone 96-49-1,
Ethylene carbonate 109-73-9, Butylamine, uses 110-71-4,
DME 123-39-7, N-Methylformamide 127-19-5, DMA 623-50-7, Ethyl
glycolate 760-79-2, N,N-Dimethylbutyramide 872-50-4, NMP, uses
6939-12-4, 3-Methyl sydnone 7226-23-5 7397-62-8, Butyl glycolate
7732-18-5, Water, uses 52922-49-3, Dibutylacetamide 57303-25-0,
N,N-Dibutyldecanamide

(solvent; ionic cond. of perfluorinated ionomeric membranes in)

L124 ANSWER 12 OF 56 HCA COPYRIGHT 2004 ACS on STN

134:353859 Studies on interactions between **Nafion** and organic
vapors by quartz crystal microbalance. Sun, L.-X.; Okada, T.
(National Institute of Materials and Chemical Research, Tsukuba,
Ibaraki, 305-8565, Japan). Journal of Membrane Science, 183(2),
213-221 (English) 2001. CODEN: JMESDO. ISSN: 0376-7388.
Publisher: Elsevier Science B.V..

AB A quartz crystal microbalance (QCM) coated with recast
Nafion film has been used to investigate the interaction
between various org. solvent vapors (carboxylic acid, alc., ketone,
amine and aldehyde) and **Nafion**. The frequency shift
caused by different vapors absorbed into **Nafion** appears to
be in the order: amine>carboxylic acid>alc.>aldehyde>ketone. Amine

seems to show the strongest interaction with **Nafion** among the above polar org. vapors due to the strongest binding energy between -NH₂ and -SO₃H of **Nafion**. Non-polar org. solvents such as hexane and chloroform exhibited a relatively weak interaction with **Nafion**. Partition coeffs. and kinetic binding rate const. between **Nafion** film and org. vapor were measured. Mol. mechanics calcn. gave binding energy change and the optimal conformations of complexes between **Nafion** and org. vapor mols. These results were in accordance with the different sorption behavior of different org. vapors on **Nafion** film.

IT 107-10-8, Propylamine, processes

(studies on interactions between **Nafion** and org. vapors by quartz crystal microbalance)

RN 107-10-8 HCA

CN 1-Propanamine (9CI) (CA INDEX NAME)

H₃C-CH₂-CH₂-NH₂

CC 37-5 (Plastics Manufacture and Processing)

Section cross-reference(s): 38

ST **Nafion** org vapor interaction; quartz crystal microbalance

Nafion vapor interaction

IT Physical process kinetics

(binding; studies on interactions between **Nafion** and org. vapors by quartz crystal microbalance)

IT Polyoxyalkylenes, properties

(fluorine- and sulfo-contg., ionomers; studies on interactions between **Nafion** and org. vapors by quartz crystal microbalance)

IT Adsorption

(gas; studies on interactions between **Nafion** and org. vapors by quartz crystal microbalance)

IT Hydrogen bonding enthalpy

(intermol.; studies on interactions between **Nafion** and org. vapors by quartz crystal microbalance)

IT Fluoropolymers, properties

(polyoxyalkylene-, sulfo-contg., ionomers; studies on interactions between **Nafion** and org. vapors by quartz crystal microbalance)

IT Ionomers

(polyoxyalkylenes, fluorine- and sulfo-contg.; studies on interactions between **Nafion** and org. vapors by quartz crystal microbalance)

IT Vapor pressure

(satn.; studies on interactions between **Nafion** and org. vapors by quartz crystal microbalance)

IT Binding energy

Desorption

Membranes, nonbiological

Partition

(studies on interactions between **Nafion** and org. vapors
by quartz crystal microbalance)

IT 64-17-5, Ethanol, processes 67-56-1, Methanol, processes
67-64-1, Acetone, processes 67-66-3, Chloroform, processes
71-23-8, Propanol, processes 79-09-4, Propionic acid, processes
107-10-8, Propylamine, processes
110-54-3, Hexane, processes 123-38-6, Propionaldehyde, processes
(studies on interactions between **Nafion** and org. vapors
by quartz crystal microbalance)

L124 ANSWER 13 OF 56 HCA COPYRIGHT 2004 ACS on STN

134:333189 Electrochemical reduction of cyanides at metallic cathodes. a
comparison with biological HCN reduction. Fedurco, Milan;
Sartoretto, Jorand; Augustynski, Jan (Department of Chemistry,
University of Geneva, Geneva, CH-1211/4, Switz.). Journal of the
Electrochemical Society, 148(3), D19-D23 (English) 2001.
CODEN: JESOAN. ISSN: 0013-4651. Publisher: Electrochemical
Society.

AB The electrochem. redn. of CN- was studied at a no. of cathodes both
in near-neutral and in alk. solns. Ni appears as the most effective
cathode material, promoting CN- redn. with current efficiencies
close to 70%, even in moderately alk. solns. In all cases, the
electroredn. of CN- leads to a mixt. of 4e- (methylamine) and 6e-
products (methane and **ammonia**). The use of **Nafion**
films loaded with Ni microparticles enabled us to markedly increase
the effective current densities for CN- redn. The electrochem.
redn. of HCN/CN- is shown to present interesting similarities and
differences with the biol. CN- redn. process.

IT 74-89-5, (Methylamine), formation (nonpreparative)
7664-41-7, **Ammonia**., formation (nonpreparative)
(in electroredn. of cyanide at metal cathodes)

RN 74-89-5 HCA

CN Methanamine (9CI) (CA INDEX NAME)

H3C-NH2

RN 7664-41-7 HCA

CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH3

CC 72-2 (Electrochemistry)

ST cyanide electroredn metal cathode; nickel **Nafion** electrode

cyanide electroredn

- IT 74-82-8, Methane, formation (nonpreparative) 74-84-0, Ethane, formation (nonpreparative) 74-85-1, Ethene, formation (nonpreparative) 74-89-5, (Methylamine), formation (nonpreparative) 7664-41-7, Ammonia), formation (nonpreparative)
(in electroredn. of cyanide at metal cathodes)

L124 ANSWER 14 OF 56 HCA COPYRIGHT 2004 ACS on STN

134:186945 **Solid polymer electrolytes,**

their manufacture, and **electrochemical** devices therefrom.

Sonobe, Hiroyuki; Uehara, Hideaki; Nakazawa, Satoshi; Suzuki, Kenji; Nishimura, Noboru; Okumura, Takafumi (Hitachi Chemical Co., Ltd., Japan; Hitachi, Ltd.). Jpn. Kokai Tokkyo Koho JP 2001043731 A2

20010216, 11 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-215470 19990729.

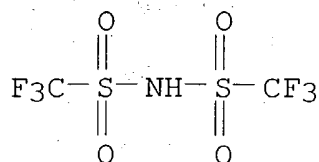
- AB The **electrolytes** comprise polyamides having polyoxyalkylene **monoamine** side chains, alkali metal salts, and nonaq. **electrolyte** solns. The above stated polyamides are obtained by reaction of (A) polyamide intermediates, formed from (a) diisocyanates or **diamines** and (b) dicarboxylic acids or tricarboxylic acid (anhydrides), with (B) epoxy resins and (C) polyoxyalkylene **monoamines**. Manuf. of the **electrolytes** by prepn. of polyamides having polyoxyalkylene **monoamine** side chains, followed by their impregnation with nonaq. **electrolyte** solns. contg. alkali metal salts is also claimed. Also claimed are polymer **electrolytes** having ion cond. $\geq 4.0 \times 10^{-4}$ S/cm and **electrochem.** devices comprising of the claimed **electrolytes**. Use of such **electrolytes** in secondary batteries was evaluated.

- IT 90076-65-6, Lithium bis(trifluoromethanesulfonyl) imide

(complexes with polyoxyalkylene-graft polyamides; manuf. of polyoxyalkylene-graft polyamides impregnated with alkali metal salts as solid **electrolytes** for **electrochem.** devices)

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

- IC ICM H01B001-06
ICS C08G059-14; H01B001-12; H01M006-18; H01M010-40; C09D163-00;
H01L031-04
- CC 76-2 (Electric Phenomena)
Section cross-reference(s): 38, 52
- ST polyoxyalkylene polyamide graft lithium complex **electrolyte**
; secondary battery polyoxyalkylene polyamide **electrolyte**
- IT Polyoxyalkylenes, uses
(epoxy-polyamide-, graft; manuf. of polyoxyalkylene-graft
polyamides impregnated with alkali metal salts as solid
electrolytes for **electrochem.** devices)
- IT Polyamides, uses
(epoxy-polyoxyalkylene-, graft; manuf. of polyoxyalkylene-graft
polyamides impregnated with alkali metal salts as solid
electrolytes for **electrochem.** devices)
- IT Polymer **electrolytes**:
(manuf. of polyoxyalkylene-graft polyamides impregnated with
alkali metal salts as solid **electrolytes** for
electrochem. devices)
- IT Polyoxyalkylenes, uses
(polyamide-, graft, alkali metal complexes; manuf. of
polyoxyalkylene-graft polyamides impregnated with alkali metal
salts as solid **electrolytes** for **electrochem.**
devices)
- IT Epoxy resins, uses
(polyamide-polyoxyalkylene-, graft; manuf. of
polyoxyalkylene-graft polyamides impregnated with alkali metal
salts as solid **electrolytes** for **electrochem.**
devices)
- IT Polyamides, uses
(polyoxyalkylene-, graft, alkali metal complexes; manuf. of
polyoxyalkylene-graft polyamides impregnated with alkali metal
salts as solid **electrolytes** for **electrochem.**
devices)
- IT 7791-03-9, Lithium perchlorate 14283-07-9, Lithium
tetrafluoroborate 21324-40-3, Lithium hexafluorophosphate

90076-65-6, Lithium bis(trifluoromethanesulfonyl) imide

(complexes with polyoxyalkylene-graft polyamides; manuf. of polyoxyalkylene-graft polyamides impregnated with alkali metal salts as solid **electrolytes** for **electrochem.** devices)

IT 83713-01-3DP, **Jeffamine** M 1000, reaction product with epoxy-contg. polyamides, lithium complexes 184687-85-2DP, Adipic acid-bisphenol A-4,4'-diphenylmethane diisocyanate-dodecanedioic acid-epichlorohydrin-sebacic acid copolymer, reaction products with polyoxyalkylene **monoamine**, lithium complexes (manuf. of polyoxyalkylene-graft polyamides impregnated with alkali metal salts as solid **electrolytes** for **electrochem.** devices)

L124 ANSWER 15 OF 56 HCA COPYRIGHT 2004 ACS on STN

134:179285 Preparation and characterization of chemically-modified perfluorinated cation-exchange platinum-containing membranes. Bessarabov, D. G.; Michaels, W.; Sanderson, R. D. (Department of Chemistry, University of Stellenbosch, Matieland, 7602, S. Afr.). Journal of Membrane Science, 179(1-2), 221-229 (English) 2000. CODEN: JMESDO. ISSN: 0376-7388. Publisher: Elsevier Science B.V..

AB Perfluorinated cation-exchange flat-sheet membranes were **treated** with ethylene **diamine** (EDA) to study the influence of EDA surface treatment on the process of platinum deposition on these membranes. The membranes were prepd. from a copolymer of tetrafluoroethylene and perfluoro-3,6-dioxa-5-methyl-1-octene-8-sulfonyl fluoride by hot pressing. Electroless chem. deposition of Pt particles on modified membranes was achieved using the Takenaka-Torikai method. Chem. modification of the surface, a profile of platinum distribution within the membrane, platinum particle size, and chem. structure of the membrane were studied by elec. cond. measurements, SEM, and IR-spectrometry. Dielec. anal. (DEA) was used to study the dipole and ion mobility of hydrolyzed EDA-treated membranes. The membranes are of interest as **solid polymer electrolytes** for **fuel cells**, electrocatalysis, O/H gas generators, ozone generators, water purifn. systems, sensors, etc.

IT 26654-97-7D, Perfluoro-3,6-dioxa-5-methyl-1-octene-8-sulfonyl fluoride-tetrafluoroethylene copolymer, reaction products with ethylenediamine, hydrolyzed (platinum-loaded; prepn. and electrochem. properties of **ethylenediamine-modified** Pt-loaded sulfonated fluoropolymer cation-exchange membranes)

RN 26654-97-7 HCA

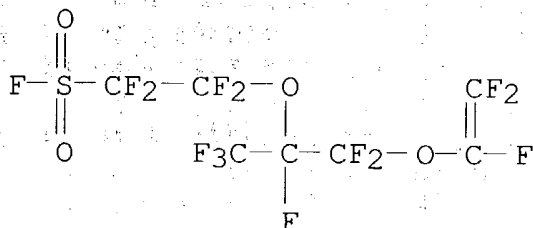
CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with

tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

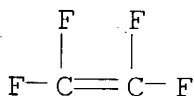
CMF C7 F14 O4 S



CM 2

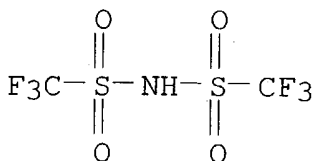
CRN 116-14-3

CMF C2 F4



- CC 37-6 (Plastics Manufacture and Processing)
 Section cross-reference(s): 38, 52, 72
- ST fluoropolymer sulfonate membrane **ethylenediamine** surface
treatment platinum uptake; cation exchange membrane
 fluoropolymer platinum deposition; **solid polymer**
 electrolyte membrane platinum loading ion mobility
- IT Ionomers
 (fluoropolymers, sulfo-contg.; prepn. and electrochem. properties
 of **ethylenediamine-modified** Pt-loaded
 sulfonated fluoropolymer cation-exchange membranes)
- IT Fluoropolymers, properties
 (ionomers, sulfo-contg.; prepn. and electrochem. properties of
ethylenediamine-modified Pt-loaded sulfonated
 fluoropolymer cation-exchange membranes)
- IT Cation exchange
 Cation exchange membranes
 Ionic conductivity
 Particle size
 Polyelectrolytes
 (prepn. and electrochem. properties of **ethylenediamine-**
modified Pt-loaded sulfonated fluoropolymer)

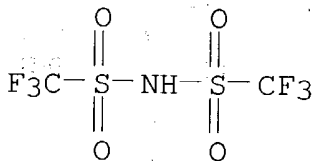
- cation-exchange membranes)
- IT Polymer morphology
(surface; prepn. and electrochem. properties of
ethylenediamine-modified Pt-loaded sulfonated
fluoropolymer cation-exchange membranes)
- IT **26654-97-7D**, Perfluoro-3,6-dioxa-5-methyl-1-octene-8-
sulfonyl fluoride-tetrafluoroethylene copolymer, reaction products
with ethylenediamine, hydrolyzed
(platinum-loaded; prepn. and electrochem. properties of
ethylenediamine-modified Pt-loaded sulfonated
fluoropolymer cation-exchange membranes)
- IT 7440-06-4, Platinum, uses
(prepn. and electrochem. properties of **ethylenediamine-**
modified Pt-loaded sulfonated fluoropolymer
cation-exchange membranes)
- IT 107-15-3, **Ethylenediamine**, reactions
(surface **treatment** reagent; prepn. and electrochem.
properties of **ethylenediamine-modified**
Pt-loaded sulfonated fluoropolymer cation-exchange membranes)
- L124 ANSWER 16 OF 56 HCA COPYRIGHT 2004 ACS on STN
- 132:267518 A new family of salts for lithium secondary batteries.
Baril, D.; Beranger, S.; Ravet, N.; Michot, C.; Armand, M.
(Universite de Montreal, Montreal, QC, H3C 3J7, Can.). Materials
Research Society Symposium Proceedings, 575(New Materials for
Batteries and Fuel Cells), 123-130 (English) **2000**. CODEN:
MRSPDH. ISSN: 0272-9172. Publisher: Materials Research Society.
- AB A novel family of salts suitable for lithium battery application was
synthesized and characterized. These salts have a large delocalized
anion whose charge is spread over a single SO₂ and a Ph ring.
Remarkable properties were obtained for the lithium
N-(3-trifluoromethyl phenyl) trifluoromethanesulfonamide salt or
LiTFPTS. The **electrochem.** stability window is around 4.0
V and its cond. in solid poly(ethylene oxide) is close to the one of
the lithium perchlorate salt. Calorimetric anal. also showed that
LiTFPTS behaves as a plasticizer since it hinders, to a certain
extent, the PEO crystn. when it is used in a **solid**
polymer matrix. Above all, its synthesis is quite
straightforward and leads to potentially inexpensive salts as the
starting **amines** are made com. on a large scale.
- IT **90076-65-6**, Lithium bis(**trifluoromethylsulfonyl**)
imide **90076-65-6D**, Lithium bis(
trifluoromethylsulfonyl)**imide**, poly(ethylene
oxide) complex
(new family of salts for lithium secondary batteries)
- RN **90076-65-6** HCA
- CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-,
lithium salt (9CI) (CA INDEX NAME)



● Li

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

CC 52#2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST lithium battery **electrolyte** salt

IT Battery **electrolytes**

Electric conductivity

Glass transition temperature

(new family of salts for lithium secondary batteries)

IT 456-64-4, N-Phenyltrifluoromethanesulfonamide 456-64-4D,

N-Phenyltrifluoromethanesulfonamide, poly(ethylene oxide) complex

23384-11-4, N-(3-Trifluoromethylphenyl)trifluoromethanesulfonamide,

53719-32-7 53719-32-7D, poly(ethylene oxide) complex

90076-65-6, Lithium bis(trifluoromethylsulfonyl)

imide 90076-65-6D, Lithium bis(

trifluoromethylsulfonyl)imide, poly(ethylene

oxide) complex

(new family of salts for lithium secondary batteries)

L124 ANSWER 17 OF 56 HCA COPYRIGHT 2004 ACS on STN

132:152905 Synthesis and characterisation of poly(methylalkoxysiloxane)

solid polymer electrolytes incorporating

different lithium salts. Morales, E.; Acosta, J. L. (Instituto de

Ciencia y Tecnologia de Polimeros, CSIC, Madrid, 28006, Spain).

Electrochimica Acta, 45(7), 1049-1056 (English) 1999.

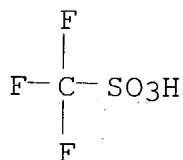
CODEN: ELCAAV. ISSN: 0013-4686. Publisher: Elsevier Science Ltd..

AB Two comb polymers with oligo-oxyethylene side chains of the type $-O-(CH_2-CH_2-O)_n-CH_3$ were prepd. from poly(methylhydrosiloxane) (PMHS). Homogeneous polymer **electrolytes** were made from the two synthesized polymers and four lithium salts having different chem. structures, such as lithium perchlorate ($LiClO_4$), lithium trifluoromethanesulfonate ($LiCF_3SO_3$), lithium hexafluorophosphate ($LiPF_6$) and lithium bis(trifluoromethane **sulfonylimide**) ($LiN(SO_2CF_3)_2$) by solvent casting method, and their thermal, elec. and **electrochem.** properties measured as a function of temp. Results indicate that polymer **electrolyte** complexes are amorphous materials, and that its properties depend on the oligo-oxyethylene chain length as well as on the chem. nature of the lithium salt.

IT 33454-82-9P, Lithium trifluoromethanesulfonate (poly(methylalkoxysiloxane) complexes; synthesis and characterization of poly(methylalkoxysiloxane) **solid polymer electrolytes** incorporating different lithium salts)

RN 33454-82-9 HCA

CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



● Li

CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 52

ST polysiloxane polyoxyethylene side chain lithium complex **solid electrolyte**

IT Activation energy

Redox reaction

(of elec. cond.; synthesis and characterization of poly(methylalkoxysiloxane) **solid polymer**

electrolytes incorporating different lithium salts)

IT Polysiloxanes, uses

Polysiloxanes, uses

(polyoxyalkylene-, graft; synthesis and characterization of poly(methylalkoxysiloxane) **solid polymer**

- electrolytes** incorporating different lithium salts)
- IT Polyoxyalkylenes, uses
Polyoxyalkylenes, uses
(polysiloxane-, graft; synthesis and characterization of
poly(methylalkoxysiloxane) **solid polymer**
electrolytes incorporating different lithium salts)
- IT Polysiloxanes, uses
(reaction products, with triethylene glycol Me ether, lithium
complexes; synthesis and characterization of
poly(methylalkoxysiloxane) **solid polymer**
electrolytes incorporating different lithium salts)
- IT Electric conductivity
Fusion enthalpy
Glass transition temperature
Polymer **electrolytes**
(synthesis and characterization of poly(methylalkoxysiloxane)
solid polymer electrolytes
incorporating different lithium salts)
- IT 7791-03-9P, Lithium perchlorate 21324-40-3P, Lithium
hexafluorophosphate 33454-82-9P, Lithium
trifluoromethanesulfonate
(poly(methylalkoxysiloxane) complexes; synthesis and
characterization of poly(methylalkoxysiloxane) **solid**
polymer electrolytes incorporating different
lithium salts)
- IT 121-44-8, **Triethylamine**, uses
(synthesis and characterization of poly(methylalkoxysiloxane)
solid polymer electrolytes
incorporating different lithium salts)
- IT 112-35-6DP, reaction products with polymethylsiloxane, complexes
with lithium 7439-93-2DP, Lithium, complexes with
poly(methylalkoxysiloxanes), uses 9004-73-3DP, Methylsilanediol
homopolymer, SRU, reaction products with triethylene glycol Me
ether, complexes with lithium 49718-23-2DP, Methylsilanediol
homopolymer, reaction products with triethylene glycol Me ether,
complexes with lithium 155940-43-5DP, Methylsilanediol-oxirane
graft copolymer, complexes with lithium
(synthesis and characterization of poly(methylalkoxysiloxane)
solid polymer electrolytes
incorporating different lithium salts)

L124 ANSWER 18 OF 56 HCA COPYRIGHT 2004 ACS on STN

131:200299 Substantially fluorinated ionomers, their manufacture and use
in conductive compositions. Feiring, Andrew Edward; Doyle,
Christopher Marc; Roelofs, Mark Gerrit; Farnham, William Brown;
Bekiarian, Paul Gregory; Blau, Hanne A. K. (E. I. Du Pont de Nemours
& Co., USA). PCT Int. Appl. WO 9945048 A1 19990910, 34
pp. DESIGNATED STATES: W: AL, AU, BA, BB, BG, BR, CA, CN, CU, CZ,

EE, GD, GE, HR, HU, ID, IL, IN, IS, JP, KP, KR, LC, LK, LR, LT, LV, MG, MK, MN, MX, NO, NZ, PL, RO, SG, SI, SK, SL, TR, TT, UA, US, UZ, VN, YU, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English). CODEN: PIXXD2.
APPLICATION: WO 1999-US4574 19990303. PRIORITY: US 1998-PV76578 19980303.

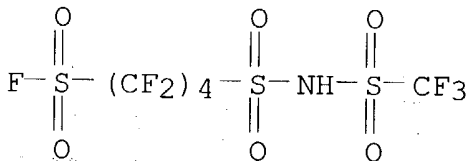
AB Substantially fluorinated but not perfluorinated ionomers, and related ionic and nonionic monomers, having vinylidene fluoride units and pendant groups contg. fluorosulfonyl methide or **fluorosulfonyl imide** derivs. and their univalent metal salts, are used in **electrochem.** applications such as batteries, **fuel cells**, **electrolysis cells**, ion exchange membranes, sensors, electrochromic windows, **electrochem.** capacitors, and modified electrodes. Thus,.

IT 241486-00-0P

(reaction with **ammonia**; substantially fluorinated ionomers, manuf. and use in conductive compns.)

RN 241486-00-0 HCA

CN 1-Butanesulfonyl fluoride, 1,1,2,2,3,3,4,4-octafluoro-4-[[[(trifluoromethyl)sulfonyl]amino]sulfonyl]-, potassium salt (9CI) (CA INDEX NAME)



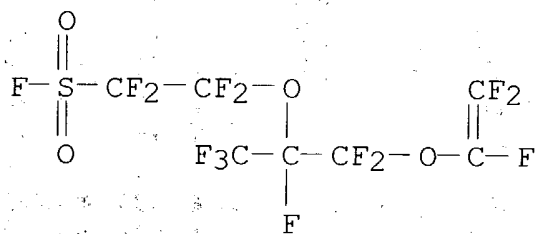
● K

IT 16090-14-5

(reaction with perfluoromethylsulfonylamine; substantially fluorinated ionomers, manuf. and use in conductive compns.)

RN 16090-14-5 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro- (9CI) (CA INDEX NAME)



IT 241485-94-9P

(substantially fluorinated ionomers, manuf. and use in conductive compns.)

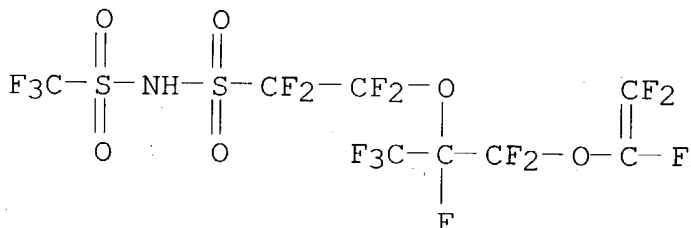
RN 241485-94-9 HCA

CN Ethanesulfonamide, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt, polymer with 1,1-difluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 235437-62-4

CMF C8 H F16 N O6 S2 . Li

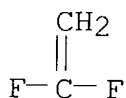


● Li

CM 2

CRN 75-38-7

CMF C2 H2 F2

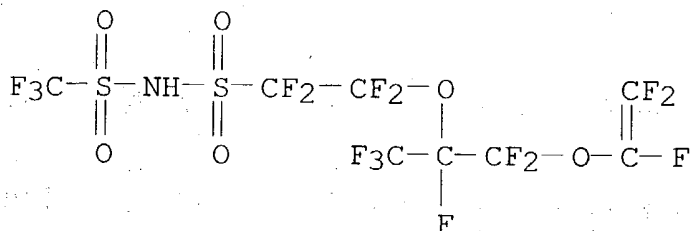


IT 162105-59-1P 241485-98-3P 241485-99-4P

(substantially fluorinated ionomers, manuf. and use in conductive compns.)

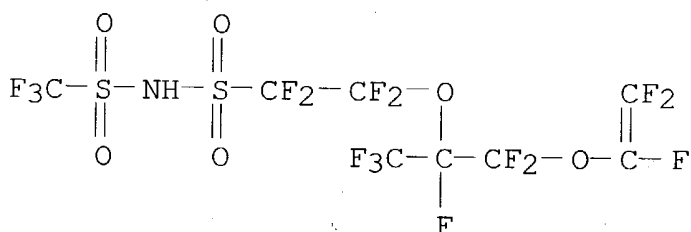
RN 162105-59-1 HCA

CN Ethanesulfonamide, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-N-[(trifluoromethyl)sulfonyl]- (9CI) (CA INDEX NAME)



RN 241485-98-3 HCA

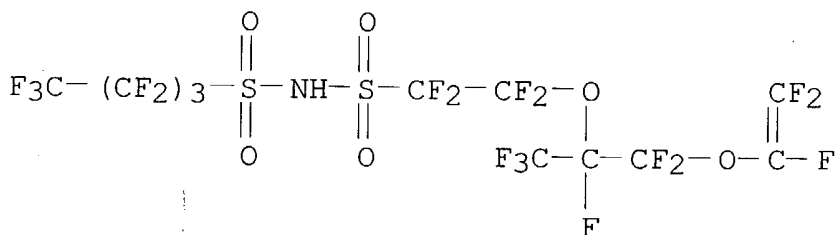
CN Ethanesulfonamide, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-N-[(trifluoromethyl)sulfonyl]-, potassium salt (9CI) (CA INDEX NAME)



● K

RN 241485-99-4 HCA

CN 1-Butanesulfonamide, N-[[2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoroethyl]sulfonyl]-1,1,2,2,3,3,4,4,4-nonafluoro- (9CI) (CA INDEX NAME)



IT 9002-84-0

(substantially fluorinated ionomers, manuf. and use in conductive compns.)

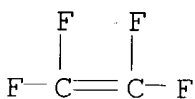
RN 9002-84-0 HCA

CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

CMF C2 F4



IT 7664-41-7, Ammonia, reactions

(substantially fluorinated ionomers, manuf. and use in conductive compns.)

RN 7664-41-7 HCA

CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH₃

IC ICM C08F214-22

ICS C07C317-18; C07C317-44; C07C311-48; C08L027-16; C08F214-22;
C08F216-14

CC 35-4 (Chemistry of Synthetic High Polymers)

Section cross-reference(s): 72

ST fluorinated ionomer conductive compn; vinylidene fluoride ionomer
conductive compn; **electrochem** cell vinylidene fluoride
ionomer; electrode vinylidene fluoride ionomer; sulfonyl methide
perfluoroalkenyl vinylidene fluoride copolymerIT **Electrochemical** cells

Electrodes

(substantially fluorinated ionomers, manuf. and use in conductive compns.)

IT 241486-00-0P

(reaction with **ammonia**; substantially fluorinated
ionomers, manuf. and use in conductive compns.)

IT 16090-14-5 105214-13-9

(reaction with perfluoromethylsulfonylamine; substantially
fluorinated ionomers, manuf. and use in conductive compns.)

IT 241485-94-9P

(substantially fluorinated ionomers, manuf. and use in conductive
compns.)

IT 162105-59-1P 241485-96-1P 241485-98-3P
241485-99-4P

(substantially fluorinated ionomers, manuf. and use in conductive compns.)

IT 9002-84-0 9002-86-2, PVC 9011-14-7, PMMA 24937-79-9
25322-68-3

(substantially fluorinated ionomers, manuf. and use in conductive compns.)

IT 7664-41-7, Ammonia, reactions

(substantially fluorinated ionomers, manuf. and use in conductive compns.)

L124 ANSWER 19 OF 56 HCA COPYRIGHT 2004 ACS on STN

131:145263 Crosslinked sulfonated polymers and method for preparing same. Michot, Christophe; Armand, Michel (Hydro-Quebec, Can.). PCT Int. Appl. WO 9938897 A1 19990805, 43 pp. DESIGNATED STATES: W: CA, JP, US; RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE. (French). CODEN: PIXXD2. APPLICATION: WO 1999-CA78-19990129. PRIORITY: CA 1998-2228467 19980130; CA 1998-2236197 19980428.

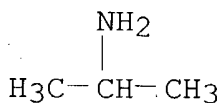
AB The invention concerns crosslinked sulfonated polymers, optionally perfluorinated, having ionic charges on the sulfo groups and the method for prepg. them. When they are molded in the form of membranes, said polymers are useful in **fuel cells** and electrochem. cells, in a chlorine-sodium electrolysis process, as separator in en electrochem. prepn. of org. and inorg. compds., as separator between an aq. phase and an org. phase, or as catalyst for Diels-Alder addns., Friedel-Craft reactions, aldol condensations, cationic polymn., esterification, and acetal formation. Thus, fluorinating a **Nafion** 117 membrane in the Li salt form by Me2NSF2 in THF, reacting the resulting membrane having SO2F groups 3 h in diglyme under reflux with hexamethyldisilazane Li salt, rinsing with THF, aging the film 48 h in THF contg. Li trimethylsilanoate, rinsing the film with water and EtOH, and exchanging the metal ions for protons by several immersions in 2 M HNO3 gave a membrane with 32% of the sulfonyl groups in the form of sulfonimide and 78% in the form of sulfonate.

IT 75-31-0, Isopropylamine, uses

(crosslinker precursor; polymers having ionic charges on sulfo crosslinking groups)

RN 75-31-0 HCA

CN 2-Propanamine (9CI) (CA INDEX NAME)

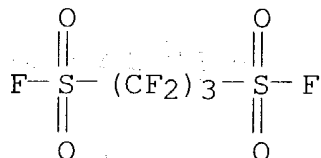


IT 82727-16-0

(crosslinker precursor; polymers having ionic charges on sulfo crosslinking groups)

RN 82727-16-0 HCA

CN 1,3-Propanedisulfonyl difluoride, 1,1,2,2,3,3-hexafluoro- (9CI) (CA INDEX NAME)

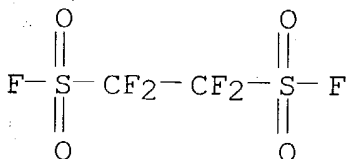


IT 84246-33-3 146829-79-0

(crosslinker; polymers having ionic charges on sulfo crosslinking groups)

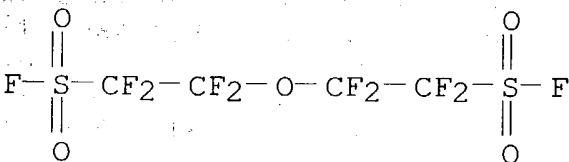
RN 84246-33-3 HCA

CN 1,2-Ethanedisulfonyl difluoride, 1,1,2,2-tetrafluoro- (9CI) (CA INDEX NAME)



RN 146829-79-0 HCA

CN Ethanesulfonyl fluoride, 2,2'-oxybis[1,1,2,2-tetrafluoro- (9CI) (CA INDEX NAME)



IT 235440-59-2P 235440-60-5DP, hydrolyzed, lithium or sodium salts 235440-63-8DP, reaction products with N-trimethylsilyltrifluoromethanesulfonamide sodium salt 235440-65-0DP, hydrolyzed, lithium salts 235440-71-8DP, hydrolyzed, lithium salts 235440-73-0DP, hydrolyzed

(polymers having ionic charges on sulfo crosslinking groups)

RN 235440-59-2 HCA

CN Silanamine, 1,1,1-trimethyl-N-(trimethylsilyl)-, sodium salt,

polymer with Nafion 117 (9CI) (CA INDEX NAME)

CM 1

CRN 66796-30-3

CMF Unspecified

CCI PMS, MAN

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CM 2

CRN 1070-89-9

CMF C6 H19 N Si2 . Na

Me₃Si-NH-SiMe₃

● Na

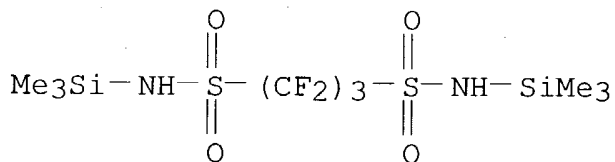
RN 235440-60-5 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with 1,1,2,2,3,3-hexafluoro-N,N'-bis(trimethylsilyl)-1,3-propanedisulfonamide disodium salt and tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 210542-03-3

CMF C9 H20 F6 N2 O4 S2 Si2 . 2 Na

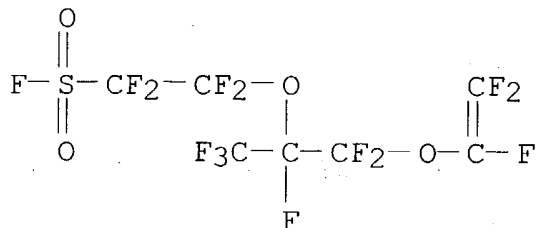


●2 Na

CM 2

CRN 16090-14-5

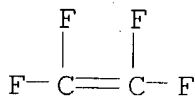
CMF C7 F14 O4 S



CM 3

CRN 116-14-3

CMF C2 F4



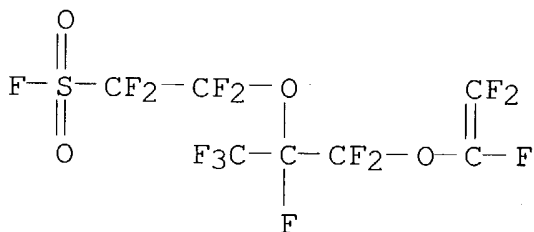
RN 235440-63-8 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene and 1,1,1-trimethyl-N-(trimethylsilyl)silanamine sodium salt (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

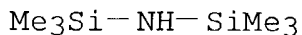
CMF C7 F14 O4 S



CM 2

CRN 1070-89-9

CMF C6 H19 N Si2 . Na

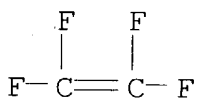


● Na

CM 3

CRN 116-14-3

CMF C2 F4



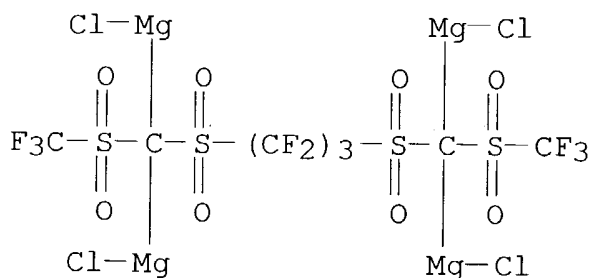
RN 235440-65-0 HCA

CN Magnesium, tetrachloro[μ4-[(1,1,2,2,3,3-hexafluoro-1,3-propanediyl)bis[[trifluoromethyl)sulfonyl)methylidyne]]]tetra-, polymer with 2-[1-[difluoro[(trifluoroethenyl)oxy)methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoroethanesulfonyl fluoride, 1,1,2,2,3,3-hexafluoro-N,N'-bis(trimethylsilyl)-1,3-propanedisulfonamide disodium salt and tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 235440-64-9

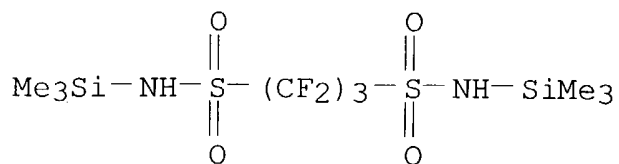
CMF C7 Cl4 F12 Mg4 O8 S4



CM 2

CRN 210542-03-3

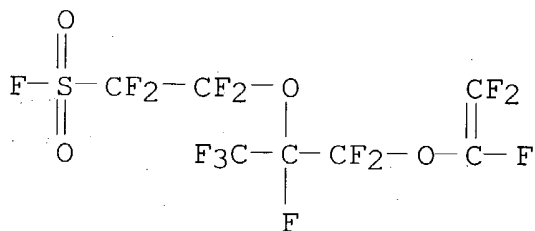
CMF C9 H20 F6 N2 O4 S2 Si2 . 2 Na



●2 Na

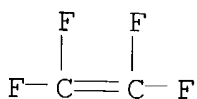
CM 3

CRN 16090-14-5
CMF C7 F14 O4 S



CM 4

CRN 116-14-3
CMF C2 F4

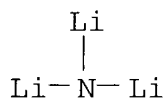


RN 235440-71-8 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with lithium nitride (Li3N) and tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

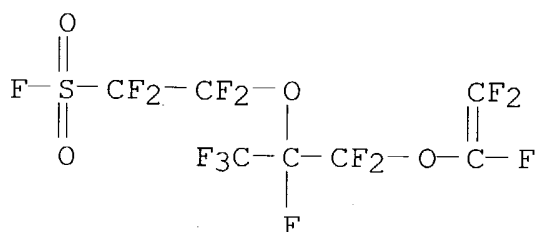
CRN 26134-62-3
CMF Li3 N



CM 2

CRN 16090-14-5

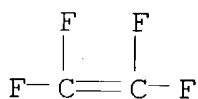
CMF C7 F14 O4 S



CM 3

CRN 116-14-3

CMF C2 F4



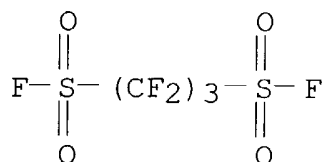
RN 235440-73-0 HCA

CN 1,3-Propanedisulfonyl difluoride, 1,1,2,2,3,3-hexafluoro-, polymer with 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoroethanesulfonyl fluoride and tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 82727-16-0

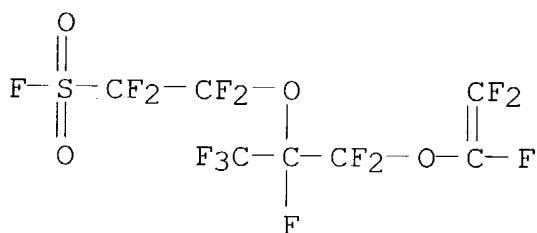
CMF C3 F8 O4 S2



CM 2

CRN 16090-14-5

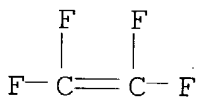
CMF C7 F14 O4 S



CM 3

CRN 116-14-3

CMF C2 F4



IC ICM C08F008-44

ICS C08G081-00; C08G085-00; C08J005-22

CC 37-6 (Plastics Manufacture and Processing)
Section cross-reference(s): 24, 35, 67, 72IT **Fuel cells**(polymers having ionic charges on sulfo crosslinking groups for
fuel cells)

IT 75-31-0, Isopropylamine, uses

(crosslinker precursor; polymers having ionic charges
on sulfo crosslinking groups)

IT 82727-16-0

(crosslinker precursor; polymers having ionic charges on sulfo
crosslinking groups)

IT 75-24-1, Trimethylaluminum 280-57-9, DABCO 917-54-4,

Methylolithium 1070-89-9, Hexamethyldisilazane sodium salt 1299-86-1, Aluminum carbide 4039-32-1, Hexamethyldisilazane lithium salt 7782-89-0, Lithium amide 7782-92-5, Sodium amide 7791-25-5, Sulfuryl chloride 7803-58-9, Sulfamide 17242-52-3, Potassium amide 26134-62-3, Lithium nitride 40949-94-8, Hexamethyldisilazane potassium salt 62619-91-4 **84246-33-3** 146829-75-6 **146829-79-0** 235440-76-3 235440-77-4 235440-78-5 235440-79-6 235440-80-9 235440-81-0 235764-57-5 (crosslinker; polymers having ionic charges on sulfo crosslinking groups)

IT 91742-20-0DP, reaction products with sulfo-crosslinked polymer **235440-59-2P** **235440-60-5DP**, hydrolyzed, lithium or sodium salts **235440-60-5DP**, reaction products with N-trimethylsilyltrifluoromethanesulfonamide sodium salt **235440-63-8DP**, reaction products with N-trimethylsilyltrifluoromethanesulfonamide sodium salt 235440-64-9P **235440-65-0DP**, hydrolyzed, lithium salts 235440-67-2DP, hydrolyzed, lithium salts 235440-69-4DP, hydrolyzed, sodium salts **235440-71-8DP**, hydrolyzed, lithium salts **235440-73-0DP**, hydrolyzed (polymers having ionic charges on sulfo crosslinking groups)

L124 ANSWER 20 OF 56 HCA COPYRIGHT 2004 ACS on STN

130:325773 Novel **solid polymer electrolyte**

and multilayer **electrochemical** assembly comprising such a **solid polymer electrolyte**. Lascaud, Stephane; Baudry, Paul; Gramain, Philippe (Electricite De France (Service National), Fr.). PCT Int. Appl. WO 9920677 A1 **19990429**, 36 pp. DESIGNATED STATES: W: CA, JP, US; RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE. (French). CODEN: PIXXD2. APPLICATION: WO 1998-FR2206 19981014. PRIORITY: FR 1997-12952 19971016.

AB The **solid polymer electrolyte**

comprises complexes of a matrix of linear and cross-linked poly(ethylene oxide) (PEO) and radical-substituted PEO segments, radical = chloromethyl, bromomethyl, iodomethyl moieties and at least one ionizable alk. metal salt, has Tg of <40°, crystallinity of less than 40%, and cond. of more than 5×10^{-6} S/cm at/above 20°. The crosslinking agents are selected from thiols, esp. trithiocyanuric acid, **amines**, esp. bis(**aminopropyl** ether), **diamine**-terminated oligoethylene oxide or oligopropylene oxide. The salts comprise metal cations, preferably Li⁺ and anions, e.g., BF₄⁻, PF₆⁻, AsF₆⁻, ClO₄⁻, SCN⁻, I⁻, Br⁻, (C₆H₅)₄B⁻, BCl₄⁻; the **electrolytes** also contain one or more inorg. compds., e.g., MgO, Al₂O₃, CaO, Li₂CO₃, CaCO₃, or glass fibers. The multilayer **electrochem**. assembly has a pos. and neg. electrodes, current collectors, sepd. by the **solid polymer electrolyte**

layer; the anode is preferably Li. Thus, a polymer **electrolyte** contg. 85.4% ethylene oxide segments and 14.6% epichlorohydrin segments was prepd.; polymn. was carried out using Et₃Al-acetylacetone catalyst in toluene under N atm. at about 107° and the obtained polymer has Tg of - 49°, m.p. of 36°, and crystallinity of 13.5%. The copolymer was dissolved in acetonitrile, and MgO, CaCO₃, or Li₂CO₃, trithiocyanuric acid, and lithium bis(trifluoromethylsulfonyl)imide; the mixt. was placed on glass slides and subjected to heat to induce crosslinking. The cond. of the films was measured using a Li/**electrolyte**/Li cell assembly at 20-90°; the cond. increased with temp. from 3.4 x 10⁻⁶ S/cm at 20° to 5.7 x 10⁻⁵ at 90°.

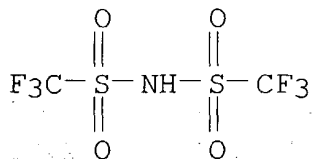
IT 90076-65-6, Lithium bis(trifluoromethylsulfonyl)imide

(**electrolyte** salt; manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer**

electrolytes and use in multilayer **electrochem.** cell)

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

IC ICM C08G065-24

ICS C08L071-03; H01M010-40

CC 37-5 (Plastics Manufacture and Processing)
Section cross-reference(s): 72

ST polyethylene oxide lithium salt **solid polymer electrolyte**; thiocyanate crosslinking ethylene oxide epichlorohydrin copolymer **electrolyte**; elec cond PEO lithium salt **solid electrolyte** cell

IT Epichlorohydrin rubber

(Hydrin 2000, lithium complexes; manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer**

electrolytes and use in multilayer **electrochem.** cell)

IT Polyoxyalkylenes, preparation

(crosslinked, lithium complexes; manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem.** cell)

IT Epichlorohydrin rubber

(epichlorohydrin-ethylene oxide, Epichlomer D, lithium complexes; manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem.** cell)

IT **Electrochemical cells**

Polymer electrolytes

(manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem.** cell)

IT Glass fibers, uses

(manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem.** cell)

IT Crosslinking

(thermal; manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem.** cell)

IT 7440-02-0, Nickel, uses

(current collectors; manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem.** cell)

IT 7439-93-2, Lithium, uses

(electrodes; manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem.** cell)

IT 471-34-1, Calcium carbonate (CaCO_3), uses 554-13-2, Lithium carbonate (Li_2CO_3) 1309-48-4, Magnesium oxide (MgO), uses

(**electrolyte** component; manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem.** cell)

IT 90076-65-6, Lithium bis(trifluoromethylsulfonyl) imide

(**electrolyte** salt; manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem.** cell)

IT 75-05-8, Acetonitrile, uses

(**electrolyte** solvent; manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem.** cell)

- IT 638-16-4DP, Trithiocyanuric acid, reaction products with epichlorohydrin-ethylene oxide copolymer, lithium complexes
7439-93-2DP, Lithium, complexes with epichlorohydrin-ethylene oxide copolymers, preparation 24969-10-6DP, Epichlorohydrin-ethylene oxide copolymer, reaction products with trithiocyanuric acid, lithium complexes 65605-36-9DP, **Jeffamine ED-600**, reaction products with epichlorohydrin-ethylene oxide copolymers, lithium complexes
(manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem. cell**)
- IT 1305-78-8, Calcium oxide, uses 1344-28-1, Alumina, uses (manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem. cell**)
- IT 97-93-8, Triethylaluminum, uses 123-54-6, Acetylacetone, uses (polymn. catalyst system; manuf. of epichlorohydrin-ethylene oxide/lithium salt **solid polymer electrolytes** and use in multilayer **electrochem. cell**)

L124 ANSWER 21 OF 56 HCA COPYRIGHT 2004 ACS on STN

128:90970 Proton conductivity in **Nafion 117** and in a novel

bis[(perfluoroalkyl)**sulfonyl**]**imide** ionomer membrane. Sumner, J. J.; Creager, S. E.; Ma, J. J. A.; DesMarteau, D. D. (Dep. Chem., Clemson Univ., Clemson, SC, 29634, USA). Journal of the Electrochemical Society, 145(1), 107-110 (English) 1998. CODEN: JESOAN. ISSN: 0013-4651. Publisher: Electrochemical Society.

AB A study of proton cond. in a com. sample of **Nafion 117** and a structurally similar bis[(perfluoroalkyl)**sulfonyl**]**imide** ionomer membrane under variable temp. and humidity conditions is reported. The **sulfonyl imide** ionomer was synthesized using a novel redox-initiated emulsion copolymn. method, and conductivities were measured using a galvanostatic four-point-probe electrochem. impedance spectroscopy technique. Both materials exhibited a strong dependence of cond. on temp. and humidity, with cond. in both cases being strongly diminished with decreasing humidity (at const. temp.) and increasing temp. (at const. water partial pressure). The obsd. behavior is consistent with a "liq.-like" mechanism of proton cond. whereby protons are transported as hydrated hydronium ions through water-filled pores and channels in the ionomer.

IT 66796-30-3, **Nafion 117**
(proton cond. in **Nafion 117** and in a novel bis[(perfluoroalkyl)**sulfonyl**]**imide** ionomer membrane)

RN 66796-30-3 HCA

CN Nafion 117 (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 38, 76
ST fuel cell electrolyte **perfluoroalkylsulfonylimide** ionomer
membrane; proton cond **Nafion** fuel cell electrolyte
IT **Imides**
(bis[(perfluoroalkyl)sulfonyl]; proton cond. in
Nafion 117 and in a novel bis[(perfluoroalkyl)
sulfonyl]imide ionomer membrane)
IT Polyoxyalkylenes, uses
(fluorine- and sulfo-contg., ionomers; proton cond. in
Nafion 117 and in a novel bis[(perfluoroalkyl)
sulfonyl]imide ionomer membrane)
IT Polyoxyalkylenes, uses
(fluorine-contg., sulfo-contg., ionomers; proton cond. in
Nafion 117 and in a novel bis[(perfluoroalkyl)
sulfonyl]imide ionomer membrane)
IT Fluoropolymers, uses
Fluoropolymers, uses
(polyoxyalkylene-, sulfo-contg., ionomers; proton cond. in
Nafion 117 and in a novel bis[(perfluoroalkyl)
sulfonyl]imide ionomer membrane)
IT Ionomers
(polyoxyalkylenes, fluorine- and sulfo-contg.; proton cond. in
Nafion 117 and in a novel bis[(perfluoroalkyl)
sulfonyl]imide ionomer membrane)
IT Fuel cell electrolytes
(proton cond. in **Nafion** 117 and in a novel
bis[(perfluoroalkyl)sulfonyl]imide ionomer
membrane)
IT Fluoropolymers, uses
Ionomers
(proton cond. in **Nafion** 117 and in a novel
bis[(perfluoroalkyl)sulfonyl]imide ionomer
membrane)
IT Ionic conductivity
(proton; proton cond. in **Nafion** 117 and in a novel
bis[(perfluoroalkyl)sulfonyl]imide ionomer
membrane)
IT 66796-30-3, **Nafion** 117
(proton cond. in **Nafion** 117 and in a novel
bis[(perfluoroalkyl)sulfonyl]imide ionomer
membrane)

& Co., USA; Drysdale, Neville Everton; Wang, Lin; Yang, Zhen-Yu).
 PCT Int. Appl. WO 9727238 A1 **19970731**, 21 pp. DESIGNATED
 STATES: W: JP, SG, US; RW: AT, BE, CH, DE, DK, ES, FI, FR, GB, GR,
 IE, IT, LU, MC, NL, PT, SE. (English). CODEN: PIXXD2.
 APPLICATION: WO 1997-US930 19970122. PRIORITY: US 1996-10515
 19960124.

AB An improved process for the polymn. of cyclic ethers to polyethers
 using strong Bronsted acid catalysts is disclosed. The catalysts
 are polymers contg. sulfonic acid groups in which the carbon atoms
 alpha and beta to the sulfonic acid group are perfluorinated or are
 bonded to perfluoroalkyl groups. The polymers also contain large
 amts. of C-bonded hydrogen atoms. The resulting polyethers are
 useful as monomers and in adhesives. Hydrolyzed ethylene copolymer
 with 8.5 mol% CH₂:CH(CH₂)₄(CF₂)₄₀(CF₂)₂SO₂F was used for polymn. of
 THF in the presence of acetic anhydride at room temp. for 22 h to
 obtain 6.65 g polymer (from 10 g monomer) with Mn 28300 and Mw
 63300.

IT **118473-68-0, Nafion NR50**
 (process for the polymn. of cyclic ethers)

RN 118473-68-0 HCA

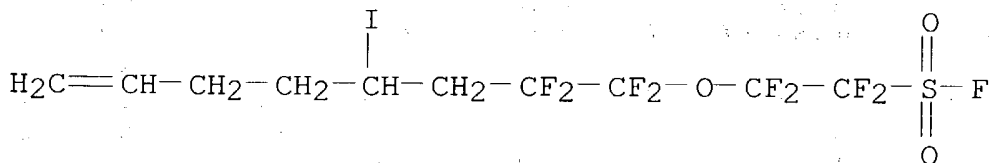
CN Nafion NR 50 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT **99930-57-1P**
 (process for the polymn. of cyclic ethers)

RN 99930-57-1 HCA

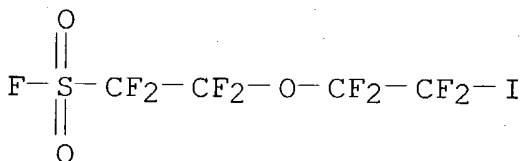
CN Ethanesulfonyl fluoride, 1,1,2,2-tetrafluoro-2-[(1,1,2,2-tetrafluoro-
 4-iodo-7-octenyl)oxy]- (9CI) (CA INDEX NAME)



IT **66137-74-4 67990-76-5 84271-36-3**
 (process for the polymn. of cyclic ethers)

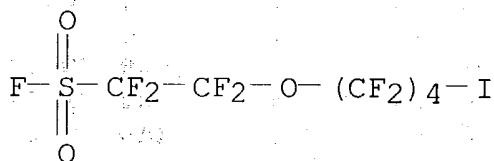
RN 66137-74-4 HCA

CN Ethanesulfonyl fluoride, 1,1,2,2-tetrafluoro-2-(1,1,2,2-tetrafluoro-
 2-iodoethoxy)- (9CI) (CA INDEX NAME)



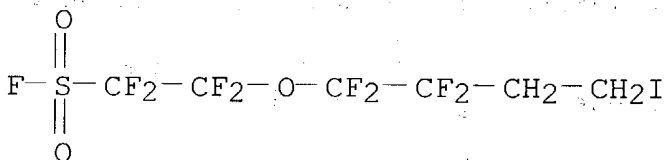
RN 67990-76-5 HCA

CN Ethanesulfonyl fluoride, 1,1,2,2-tetrafluoro-2-(1,1,2,2,3,3,4,4-octafluoro-4-iodobutoxy)- (9CI) (CA INDEX NAME)



RN 84271-36-3 HCA

CN Ethanesulfonyl fluoride, 1,1,2,2-tetrafluoro-2-(1,1,2,2-tetrafluoro-4-iodobutoxy)- (9CI) (CA INDEX NAME)



IC ICM C08G065-20

ICS C08G065-10

CC 35-4 (Chemistry of Synthetic High Polymers)

IT 118473-68-0, Nafion NR50

(process for the polymn. of cyclic ethers)

IT 99930-57-1P 106609-19-2P 181709-19-3P 181709-20-6P

193894-26-7P 193894-27-8P 193894-28-9P

(process for the polymn. of cyclic ethers)

IT 74-85-1, Ethene, reactions 42296-74-2, Hexadiene

66137-74-4 67990-76-5 84271-36-3

(process for the polymn. of cyclic ethers)

L124 ANSWER 23 OF 56 HCA COPYRIGHT 2004 ACS on STN

127:123073 Iodonitriles as chain-transfer agents in the manufacture of perfluoropolymers. Hung, Ming-Hong; Logothetis, Anestis Leonidas; Yang, Zhen-Yu (E. I. Du Pont de Nemours & Co., USA; Hung, Ming-Hong; Logothetis, Anestis Leonidas; Yang, Zhen-Yu). PCT Int. Appl. WO 9722636 A2 19970626, 18 pp. DESIGNATED STATES: W: JP, US; RW: AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE. (English). CODEN: PIXXD2. APPLICATION: WO 1996-US19645 19961212. PRIORITY: US 1995-8951 19951220.

AB Iodoperfluoroalkylnitriles are used in the free radical polymn. of vinyl monomers to form perfluoropolymers having end groups which may take part in a crosslinking reaction. These nitriles have a relatively low toxicity. The resulting perfluoropolymers are useful as molding resins and elastomers, particularly for parts where good

chem. resistance and/or high temp. resistance are desirable. Thus, perfluoro(8-cyano-5-methyl-3,6-dioxo-1-octene)-perfluoro(Me vinyl ether)-tetrafluoroethylene copolymer for O rings was prepd. using 1-iodo-2-cyanoperfluoroethylene as a chain-transfer agent.

IT 192569-11-2P

(manuf. of)

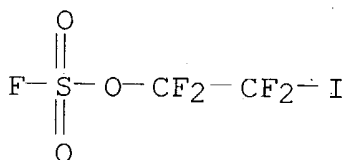
RN 192569-11-2 HCA

CN Fluorosulfuric acid, 1,1,2,2-tetrafluoro-2-iodoethyl ester, telomer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 77570-00-4

CMF C2 F5 I O3 S



CM 2

CRN 9002-84-0

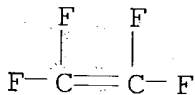
CMF (C2 F4)x

CCI PMS

CM 3

CRN 116-14-3

CMF C2 F4



IT 7664-41-7, Ammonia, reactions

(reaction of Et iododifluoroacetate with ammonia for manuf. of iododifluoroacetamide)

RN 7664-41-7 HCA

CN Ammonia (8CI, 9CI) (CA INDEX NAME)

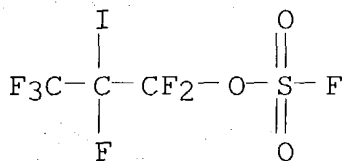
NH₃

IT 77570-01-5P

(reaction of iodine monochloride and fluorosulfonic acid and hexafluoropropylene for manuf. of iodohexafluoropropyl fluorosulfate)

RN 77570-01-5 HCA

CN Fluorosulfuric acid, 1,1,2,3,3,3-hexafluoro-2-iodopropyl ester (9CI)
(CA INDEX NAME)

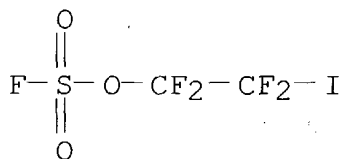


IT 77570-00-4P

(reaction of iodine monochloride and fluorosulfonic acid and tetrafluoroethylene for manuf. of iodotetrafluoroethyl fluorosulfate)

RN 77570-00-4 HCA

CN Fluorosulfuric acid, 1,1,2,2-tetrafluoro-2-iodoethyl ester (9CI)
(CA INDEX NAME)

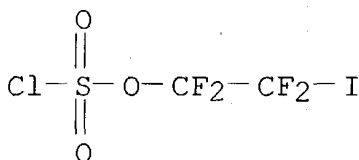


IT 192569-10-1P

(reaction of iodine monochloride with chlorosulfonic acid and tetrafluoroethylene for manuf. of iodotetrafluoroethyl chlorosulfate)

RN 192569-10-1 HCA

CN Chlorosulfuric acid, 1,1,2,2-tetrafluoro-2-iodoethyl ester (9CI)
(CA INDEX NAME)



IT 192569-07-6P 192569-09-8P

(rubber; iodonitriles as chain-transfer agents in manuf. of perfluoropolymers for O rings)

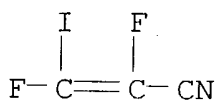
RN 192569-07-6 HCA

CN Propanenitrile, 3-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-2,2,3,3-tetrafluoro-, telomer with 2,3-difluoro-3-iodo-2-propenenitrile, tetrafluoroethene and trifluoro(trifluoromethoxy)ethene (9CI) (CA INDEX NAME)

CM 1

CRN 192569-06-5

CMF C3 F2 I N



CM 2

CRN 71832-66-1

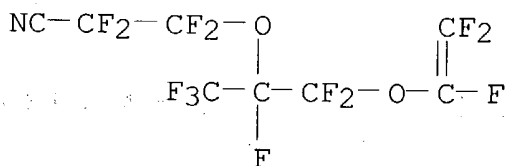
CMF (C8 F13 N O2 . C3 F6 O . C2 F4) x

CCI PMS

CM 3

CRN 69804-19-9

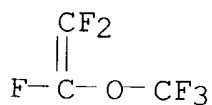
CMF C8 F13 N O2



CM 4

CRN 1187-93-5

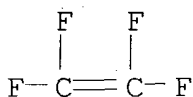
CMF C3 F6 O



CM 5

CRN 116-14-3

CMF C2 F4



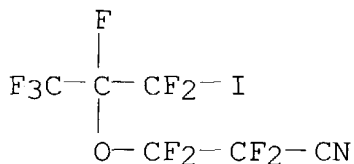
RN 192569-09-8 HCA

CN Propanenitrile, 3-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-2,2,3,3-tetrafluoro-, telomer with 3-[1-(difluoriodomethyl)-1,2,2,2-tetrafluoroethoxy]-2,2,3,3-tetrafluoropropanenitrile, tetrafluoroethene and trifluoro(trifluoromethoxy)ethene (9CI) (CA INDEX NAME)

CM 1

CRN 192569-08-7

CMF C6 F10 I N O



CM 2

CRN 71832-66-1

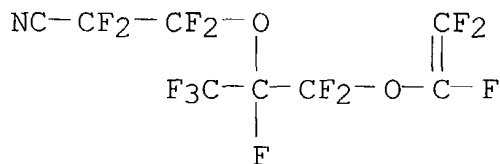
CMF (C8 F13 N O2 . C3 F6 O . C2 F4)x

CCI PMS

CM 3

CRN 69804-19-9

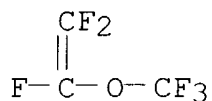
CMF C8 F13 N O2



CM 4

CRN 1187-93-5

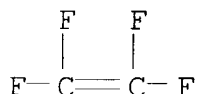
CMF C3 F6 O



CM 5

CRN 116-14-3

CMF C2 F4



IC ICM C08F014-18

CC 42-11 (Coatings, Inks, and Related Products)

Section cross-reference(s): 35, 39

IT 192569-11-2P

(manuf. of)

IT 7664-41-7, Ammonia, reactions

(reaction of Et iododifluoroacetate with ammonia for
manuf. of iododifluoroacetamide)

IT 7553-56-2, Iodine, reactions 19448-33-0,

Trifluoromethoxypentafluorocyclopropane

(reaction of iodine and trifluoromethoxypentafluorocyclopropane
and ammonia for manuf. of iodotetrafluoropropanoamide)

IT 77570-01-5P

(reaction of iodine monochloride and fluorosulfonic acid and
hexafluoropropylene for manuf. of iodoheptafluoropropyl
fluorosulfate)

IT 77570-00-4P

(reaction of iodine monochloride and fluorosulfonic acid and
tetrafluoroethylene for manuf. of iodotetrafluoroethyl
fluorosulfate)

IT 192569-10-1P

(reaction of iodine monochloride with chlorosulfonic acid and
tetrafluoroethylene for manuf. of iodotetrafluoroethyl
chlorosulfate)

IT 192569-07-6P 192569-09-8P

(rubber; idonitriles as chain-transfer agents in manuf. of
perfluoropolymers for O rings)

L124 ANSWER 24 OF 56 HCA COPYRIGHT 2004 ACS on STN

126:318296 Treatment of the surface of halogenated polymers and preparation of treatment baths by electrolysis. Marzouk, Hatem; Combellas, Catherine; Kanoufi, Frederic; Thiebault, Andre (Electricite De France, Fr.). Fr. Demande FR 2737727 A1 19970214, 20 pp. (French). CODEN: FRXXBL. APPLICATION: FR 1995-9726 19950810.

AB The title process consists of electrolyzing a soln. contg. metal salts (from alkali metals, alk. earth metals, Mg, or Al) in a solvent (liq. **NH3**, primary amines, Me2O, THF, amides, or nitriles) using an inert cathode and an oxidizable or consumable anode, immersing the polymer to be treated in the electrolyzed soln., and rinsing the treated polymer. The treated polymers are typically metalized. A soln. of **NH4BF4** in liq. **NH3** (at -38°) was electrolyzed using a stainless steel cathode and a magnesium anode to give a soln. contg. **Mg(BF4)2** and solvated electrons. **Nafion** was treated by immersion into the soln.

IT 7664-41-7, Ammonia, uses
(liq.; treatment of the surface of halogenated polymers and prepn. of treatment baths by electrolysis)

RN 7664-41-7 HCA

CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH3

IT 74-89-5, Methylamine, uses 75-04-7, Ethylamine, uses 107-10-8, Propylamine, uses

(treatment of the surface of halogenated polymers and prepn. of treatment baths by electrolysis)

RN 74-89-5 HCA

CN Methanamine (9CI) (CA INDEX NAME)

H3C-NH2

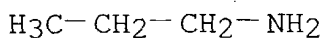
RN 75-04-7 HCA

CN Ethanamine (9CI) (CA INDEX NAME)

H3C-CH2-NH2

RN 107-10-8 HCA

CN 1-Propanamine (9CI) (CA INDEX NAME)



- IT 170006-88-9, Nafion 350
(treatment of the surface of halogenated polymers and prepn. of treatment baths by electrolysis)
- RN 170006-88-9 HCA
- CN Nafion 350 (9CI) (CA INDEX NAME)
- *** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
- IC ICM C08J007-00
- ICS C23C018-54; C23C018-31; C25B001-14; C25B001-00
- ICI C08L101-04, C08L027-12
- CC 38-2 (Plastics Fabrication and Uses)
- ST halogenated polymer surface treatment; electrolysis metal salt soln; amine solvent treatment soln; ammonia solvent treatment soln; amide solvent treatment soln; nitrile solvent treatment soln
- IT 7664-41-7, Ammonia, uses
(liq.; treatment of the surface of halogenated polymers and prepn. of treatment baths by electrolysis)
- IT 68-12-2, Dimethylformamide, uses 74-89-5, Methylamine, uses 75-04-7, Ethylamine, uses 75-05-8, Acetonitrile, uses 107-10-8, Propylamine, uses 107-15-3, Ethylenediamine, uses 109-99-9, THF, uses 115-10-6, Dimethyl ether 1608-26-0 14708-13-5, Magnesium tetrafluoroborate 104824-65-9, Magnesium cyanoacetate
(treatment of the surface of halogenated polymers and prepn. of treatment baths by electrolysis)
- IT 9002-83-9, Polytrifluorochloroethylene 9002-84-0, Polytetrafluoroethylene 24937-79-9, Polyvinylidene fluoride 170006-88-9, Nafion 350
(treatment of the surface of halogenated polymers and prepn. of treatment baths by electrolysis)

L124 ANSWER 25 OF 56 HCA COPYRIGHT 2004 ACS on STN

123:172062 Enhancing performance of perfluorinated ionomer membranes via dopant incorporation, method of making them and the membranes. Pellegrino, John; Noble, Richard D.; Rabago, Robert; Koval, Carl (The University of Colorado Foundation, Inc., USA). U.S. US 5417832 A 19950523, 10 pp. (English). CODEN: USXXAM. APPLICATION: US 1992-935016 19920825.

AB The present invention describes a perfluorinated ionomer membrane (contg. a surfactant) having a improved transport characteristics and are useful in a no. of sepn. processes, including the sepn. of NH3 from gaseous and liq. mixts., in the prodn. of NaOH and Cl2 gas from the electrolytic dissoln. of NaCl, in the sepn. of

toxic and radioactive metals from aq. streams, and in solid polymer electrolyte H₂/O₂ fuel cells.

The resulting membranes have a measurably altered membrane microstructure and improved transport characteristics over prior art membranes. The present invention describes the method of producing the improved membranes. Thus, a membranes was formed by casting Nafion 1100 contg. K perfluorooctane sulfonate in a solvent to give a microstructure nonporous perfluorinated membrane.

IT 29081-56-9D, FC 93, perfluoropolymer doped with
(FC 93; enhancing performance of perfluorinated ionomer membranes via dopant incorporation, method of making them and the membranes)

RN 29081-56-9 HCA

CN 1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, ammonium salt (8CI, 9CI) (CA INDEX NAME)

HO₃S- (CF₂)₇-CF₃

● NH₃

IT 2795-39-3D, Potassiumperfluorooctane sulfonate, perfluoropolymer doped with 12751-11-0D, FC 98, perfluoropolymer doped with
(enhancing performance of perfluorinated ionomer membranes via dopant incorporation, method of making them and the membranes)

RN 2795-39-3 HCA

CN 1-Octanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluoro-, potassium salt (8CI, 9CI) (CA INDEX NAME)

HO₃S- (CF₂)₇-CF₃

● K

RN 12751-11-0 HCA

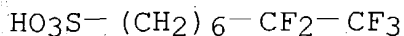
CN Octene-1-sulfonic acid, pentadecafluoro-, potassium salt (9CI) (CA INDEX NAME)

CM 1

CRN 102777-88-8

CMF C8 H3 F15 O3 S

CCI IDS



10 (D1-F)

- IT 93615-63-5D, Nafion 1100, reaction products with surfactant
(sulfonate-doped; enhancing performance of perfluorinated ionomer membranes via dopant incorporation, method of making them and the membranes)
- RN 93615-63-5 HCA
CN Nafion 1100 (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
IC ICM C25B013-08
NCL 204296000
CC 38-3 (Plastics Fabrication and Uses)
- IT 29081-56-9D, FC 93, perfluoropolymer doped with
(FC 93; enhancing performance of perfluorinated ionomer membranes via dopant incorporation, method of making them and the membranes)
- IT 2386-54-1D, Sodium butanesulfonate, perfluoropolymer doped with
2795-39-3D, Potassiumperfluorooctane sulfonate,
perfluoropolymer doped with 5324-84-5D, Sodium octanesulfonate,
perfluoropolymer doped with 12751-11-0D, FC 98,
perfluoropolymer doped with
(enhancing performance of perfluorinated ionomer membranes via dopant incorporation, method of making them and the membranes)
- IT 93615-63-5D, Nafion 1100, reaction products with surfactant
(sulfonate-doped; enhancing performance of perfluorinated ionomer membranes via dopant incorporation, method of making them and the membranes)

L124 ANSWER 26 OF 56 HCA COPYRIGHT 2004 ACS on STN

120:56689 Manufacture of N-substituted m-aminophenol derivatives for dye intermediates. Fujii, Hiroshi; Igaki, Tetsuo; Shibasaki, Hiroaki; Takahashi, Susumu (Nippon Soda Co, Japan). Jpn. Kokai Tokkyo Koho JP 05170710 A2 19930709 Heisei, 3 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1991-354988 19911220.

AB The m-aminophenol derivs., useful for thermal and pressure-sensitive recording papers, are manufd. by reaction of resorcin and primary amines in org. solvents in the presence of ZnCl_2 and silica gel, perfluoro ion exchange polymer, and/or H_2O . Thus, resorcin was treated with propylamine in pseudocumene in the

presence of ZnCl₂ and Daiso gel IR-60 (silica gel) to give yellow 3-N-propylaminophenol.

IT 118473-68-0, Nafion NR 50
(catalysts, in prepn. of aminophenol deriv.)

RN 118473-68-0 HCA

CN Nafion NR 50 (9CI) (CA INDEX NAME)

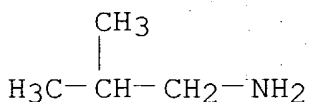
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 78-81-9, Isobutylamine 107-10-8, Propylamine,
reactions

(reaction of, with resorcin)

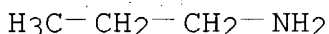
RN 78-81-9 HCA

CN 1-Propanamine, 2-methyl- (9CI) (CA INDEX NAME)



RN 107-10-8 HCA

CN 1-Propanamine (9CI) (CA INDEX NAME)



IC ICM C07C215-76

ICS B01J027-138; B01J031-08; C07C213-02

ICA C07B061-00

CC 41-9 (Dyes, Organic Pigments, Fluorescent Brighteners, and
Photographic Sensitizers)

Section cross-reference(s): 74

IT 7646-85-7, Zinc chloride, uses 118473-68-0, Nafion
NR 50

(catalysts, in prepn. of aminophenol deriv.)

IT 78-81-9, Isobutylamine 107-10-8, Propylamine,
reactions 108-91-8, Cyclohexylamine, reactions
(reaction of, with resorcin)

L124 ANSWER 27 OF 56 HCA COPYRIGHT 2004 ACS on STN

118:265556 Incorporation of hydroxamic acid ligands into Nafion
film electrodes. Arrigan, Damien W. M.; Deasy, Brian; Glennon,
Jeremy D.; Johnston, Brian; Svehla, Gyula (Dep. Chem., Univ. Coll.,
Cork, Ire.). Analyst (Cambridge, United Kingdom), 118(4), 355-9
(English) 1993. CODEN: ANALAO. ISSN: 0003-2654.

AB This paper describes studies on Nafion-coated glassy
carbon electrodes incorporating hydroxamic acids. Desferrioxamine,
a trihydroxamic acid, and glycine hydroxamate, a monohydroxamic
acid, can be incorporated by ion exchange into the Nafion
film. These ligands were detected in the film visually, after

reaction with iron(III), and electrochem., by voltammetric oxidn. The complex of iron(III) with desferrioxamine was electrochem. active at the iron(III) center in the **Nafion** film. The electrochem. of this complex in the film agrees well with the soln. electrochem. reported by other workers: irreversible at low pH and reversible at high pH. The ability of the modified electrode to act as a sensor for iron(III) was assessed. Complexation of iron(III) from dil. soln. into the polymer film was possible, and $5 + 10^{-7}$ mol L⁻¹ iron(III) could be detected after a 10 min preconcn., with differential-pulse voltammetric detection in pH 10 ammonia buffer.

CC 79-2 (Inorganic Analytical Chemistry)

Section cross-reference(s): 72

ST hydroxamic acid **Nafion** film electrode iron; electrode

hydroxamic acid **Nafion** film modified;

desferrioxamine modified Nafion film

electrode iron; glycine hydroxamate **Nafion** film electrode

iron; iron 3 detection **Nafion** film electrode

IT Electrodes

(voltammetric, hydroxamic acid ligands modified **Nafion** film coated glassy carbon as, for detection of iron(III))

IT 70-51-9, Desferrioxamine 5349-80-4, Glycine hydroxamic acid

(**Nafion** film glassy carbon electrode modified with, for detection of iron(III))

IT 7439-89-6, Iron, analysis

(detection of trivalent, incorporation of hydroxamic acid ligands into **Nafion** film electrodes for)

IT 7440-44-0, Carbon, analysis

(glassy, hydroxamic acid ligand modified **Nafion** film coated, as electrode for detection of iron(III))

L124 ANSWER 28 OF 56 HCA COPYRIGHT 2004 ACS on STN

118:168658 A useful synthesis of ω -iodoperfluoroalkanesulfonyl

fluorides and perfluoroalkane- α,ω -bis-sulfonyl

fluorides. Qiu, Weiming; Burton, Donald J. (Dep. Chem., Univ. Iowa, Iowa City, IA, 52242, USA). Journal of Fluorine Chemistry, 60(1), 93-100 (English) 1993. CODEN: JFLCAR. ISSN: 0022-1139.

OTHER SOURCES: CASREACT 118:168658.

AB ω -Iodoperfluoroalkanesulfonyl fluorides $I(CF_2)_nSO_2F$ ($n = 3, 4, 6$) and perfluoroalkane- α,ω -bis-sulfonyl fluorides

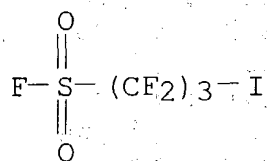
$FSO_2(CF_2)_nSO_2F$ ($n = 3, 4, 6$) have been prepd. via sequential sulfonation, chlorination, and then chlorine-fluorine exchange reaction of α,ω -diiodoperfluoroalkanes $I(CF_2)_nI$ ($n = 3, 4, 6$). Similar reaction of $I(CF_2)_2O(CF_2)_2SO_2F$ affords $FSO_2(CF_2)_2O(CF_2)_2SO_2F$.

IT 146829-76-7P

(prepn. of)

RN 146829-76-7 HCA

CN 1-Propanesulfonyl fluoride, 1,1,2,2,3,3-hexafluoro-3-iodo- (9CI)
(CA INDEX NAME)



CC 23-12 (Aliphatic Compounds)

IT 82727-16-0P 84246-31-1P 144368-88-7P 146829-76-7P
146829-77-8P 146829-78-9P 146829-79-0P
(prepn. of)

L124 ANSWER 29 OF 56 HCA COPYRIGHT 2004 ACS on STN

115:279447 Preparation of carboxylic acid ester and formamide and recovery of catalyst by **electrolysis**. Ishikawa, Jiro; Abe, Takafumi; Higuchi, Hirobumi; Kida, Koichi (Mitsubishi Gas Chemical Co., Inc., Japan). Jpn. Kokai Tokkyo Koho JP 03141242 A2 19910617 Heisei, 5 pp. (Japanese). CODEN: JKXXAF.
APPLICATION: JP 1989-278350 19891027.

AB A carboxylic acid ester and formamide are prepd. by reaction of (1) a carboxylic acid amide with formic acid ester or (2) a carboxylic acid amide with an alc. and CO, in the presence of a metal alcoholate catalyst, while the catalyst is recovered by **electrolysis** of the reaction mixt. in an **electrolytic** bath having a cathode chamber and an anode chamber sepd. by a cation exchange membrane. Thus, 12 g NaOH (1 wt.% soln. in MeOH) was charged to a cathode chamber with a Pt-plated Ti plate cathode and to an anode chamber with a Ni plate anode α -hydroxyisobutyramide (I) 0.1, HCO₂Me 0.2, and MeOH 0.3 mol in a dual-chamber **electrolytic** bath having the cathode and anode chamber sepd. by Nafion 324. A 0.3A of d.c. was applied between the cathode and the anode for 1 h at .apprx.30V and 97% Na was transferred to the anode chamber. The anode soln. obtained was charged to an autoclave and heated for 2 h at 60° to give Me α -hydroxyisobutyrate and formamide with 98 and 99% selectivity, resp., and 63% conversion of I.

IC ICM C07C069-675

ICS C07C233-03; C25B001-14; C25B001-18

CC 23-18 (Aliphatic Compounds)

ST carboxylic acid ester formamide prepn; formic acid ester transamidation carboxamide; **electrolysis** metal alcoholate catalyst recovery

IT Amidation

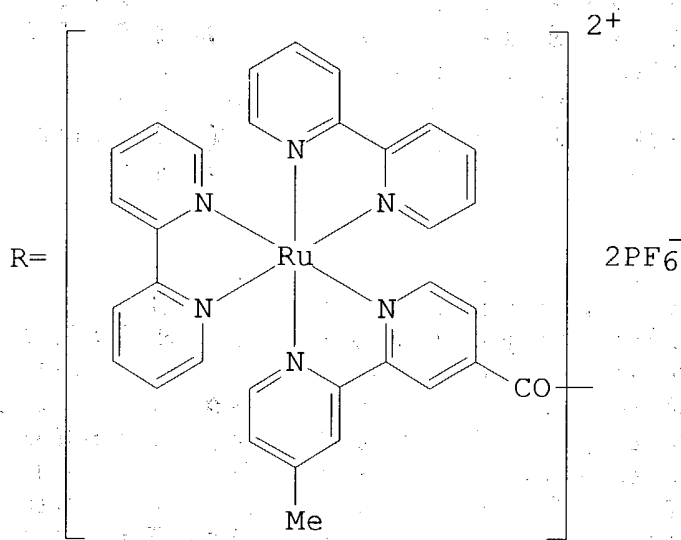
(trans-, of carboxylic acid amides with formic acid ester, carboxylate ester and formamide from)

IT 1310-73-2, Sodium hydroxide, uses and miscellaneous:
(transamidation catalyst, for carboxylic acid amide with formic
acid ester, recovery of, **electrolysis** for)

L124 ANSWER 30 OF 56 HCA COPYRIGHT 2004 ACS on STN

115:208576 Synthesis of redox derivatives of lysine and related peptides
containing phenothiazine of tris(2,2'-bipyridine)ruthenium(II).
Peek, Brian M.; Ross, Glenn T.; Edwards, Stephen W.; Meyer, Gerald
J.; Meyer, Thomas J.; Erickson, Bruce W. (Dep. Chem., Univ. North
Carolina, Chapel Hill, NC, 27599-3290, USA). International Journal
of Peptide & Protein Research, 38(2), 114-23 (English) 1991
. CODEN: IJPPC3. ISSN: 0367-8377. OTHER SOURCES: CASREACT
115:208576.

GI



AB The title lysine derivs. Boc-Lys(R)-OH (Boc = Me₃CO₂C) and
Boc-Lys(COCH₂CH₂R₁)-OH (R₁ = 10H-phenothiazin-10-yl), and peptides
Ac-Ala-Lys(COCH₂CH₂R₁)-Ala-OH and R-Ala-Lys(COCH₂CH₂R₁)-Ala-OH were
prepd. by soln. and solid-phase methods, resp. The redox behavior
of these amino acids and peptides is similar to those of
phenothiazine deriv. R₁CH₂CH₂CO₂H or ruthenium complexes ROH and
RNHMe.

CC 34-3 (Amino Acids, Peptides, and Proteins)
Section cross-reference(s): 78

ST **electrochem** redox tripeptide;
phenothiazinylpropionyllysine peptide **electrochem** redox;

IT ruthenium complex lysine peptide redox
 Redox reaction
 (electrochem., of tripeptides contg. phenothiazine and
 tris(bipyridine)ruthenium groups)

IT 136832-75-2
 (side chain amidation of, with bipyridinecarboxylic
 acid)

IT 15761-38-3, N-tert-Butoxycarbonylalanine 15761-38-3D,
 N-tert-Butoxycarbonylalanine, resin-bound
 (solid-phase peptide coupling reactions of, redox
 tripeptides from)

L124 ANSWER 31 OF 56 HCA COPYRIGHT 2004 ACS on STN:

115:30414 A novel **solid polymer electrolyte**

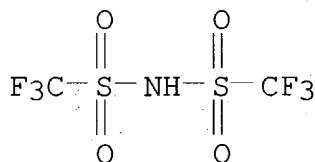
: synthesis and characterization. Callens, Sophie; Le Nest, Jean
 Francois; Gandini, Alessandro; Armand, Michel (Ec. Fr. Papet. Ind.
 Graphiques, St. Martin d'Heres, F-38402, Fr.). Polymer Bulletin
 (Berlin, Germany), 25(4), 443-50 (English) 1991. CODEN:
 POBUDR. ISSN: 0170-0839.

AB A new polyether network was prepd. using a poly(ethylene oxide) (I)
 triol and a I diisocyanate, the latter component arising from the
 chem. modification of com. I **diamines**. The physicochem.
 properties of the network alone and with LiClO₄ were assessed in
 comparison with those of previously obtained structures. Ionic
 conductivities were higher with this new system. Replacement of
 LiClO₄ by LiN(CF₃SO₂)₂ improved the cond. further because of the
 plasticizing role of the imidic anion.

IT 90076-65-6
 (polyether-polyurethane networks contg., solid
electrolytes from, prepn. and characterization of,
 plasticization effects in relation to)

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-,
 lithium salt (9CI) (CA INDEX NAME)



● Li

CC 37-3 (Plastics Manufacture and Processing)
 ST polyoxyethylene network solid **electrolyte**; polyether

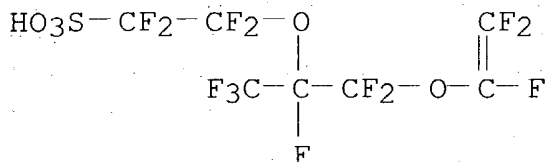
- polyurethane network **electrolyte** cond
- IT Plasticization
(of solid polyelectrolytes based on polyether-polyurethane networks contg. lithium bis(trifluoromethylsulfonyl) imide)
- IT Urethane polymers, preparation
(polyether-, networks, solid **electrolytes** from, prepn. and characterization of)
- IT 134708-59-1P
(networks, solid **electrolytes** from, prepn. and characterization of)
- IT 7791-03-9
(polyether-polyurethane networks contg., solid **electrolytes** from, prepn. and characterization of)
- IT 90076-65-6
(polyether-polyurethane networks contg., solid **electrolytes** from, prepn. and characterization of, plasticization effects in relation to)
- L124 ANSWER 32 OF 56 HCA COPYRIGHT 2004 ACS on STN
- 112:86675 Application of **Nafion** as a **polymer**
solid electrolyte for voltammetry in the absence of a contacting electrolyte solution. Harth, Rachel; Mor, Uri; Ozer, Dan; Bettelheim, Armand (Nucl. Res. Cent., Negev, Beer-Sheva, 84190, Israel). Journal of the Electrochemical Society, 136(12), 3863-7 (English) 1989. CODEN: JESOAN. ISSN: 0013-4651.
- AB A macro three-electrode cell which employs a thin **Nafion** ionically conductive film which is contacted by a moist gas is described. In contrast to the modified electrodes concept, the expts. described here were conducted with no contacting electrolyte soln. Also, the Ag wire pseudo ref. electrode used in previous studies was replaced by a polymeric **Nafion**-Ag/AgCl ref. electrode. It enabled the measurement of stable redox potentials for various compds. (+0.27, +0.37, and -0.21 V for K₃Fe(CN)₆, K₃W(CN)₈, and Ru(NH₃)₆Cl₃, resp.) and close to those measured for the same compds. when dissolved in aq. solns. using a conventional Ag/AgCl ref. electrode (+0.30, +0.34, and -0.23 V, resp.). The overpotential for the redn. of O₂ using electropolymd. Co tetrakis(o-aminophenyl)porphyrin was reduced by 280 mV in the present configuration compared to the previous one in which polyethylene oxide films and a Ag wire pseudo ref. electrode (E_{d1/2} = +0.25 and -0.03 V vs. Ag/AgCl, resp.) was used.
- IT 31175-20-9
(electrolyte, for voltammetry in the absence of contacting electrolyte soln.)
- RN 31175-20-9 HCA
- CN Ethanesulfonic acid, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with

tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 29311-67-9

CMF C7 H F13 O5 S



CM 2

CRN 116-14-3

CMF C2 F4



CC 72-2 (Electrochemistry)

Section cross-reference(s): 29, 38, 67, 76

ST **Nafion** electrolyte voltammetry moist gas; redox potential**Nafion** electrolyte; oxygen electroredn **Nafion**

cobalt porphyrin; cobalt porphyrin polymer catalyst oxygen

electrochem; silver chloride **Nafion** ref electrode

IT Electrodes

(glassy carbon with **Nafion** intermediate layer coated

with cobalt tetrakis(aminophenyl)porphyrin polymer complex)

IT Reduction, electrochemical

(of oxygen on glassy carbon coated with cobalt

tetrakis(aminophenyl)porphyrin polymer complex with

Nafion intermediate layer in the absence of contacting electrolyte soln.)

IT Reduction catalysts

(electrochem., cobalt tetrakis(aminophenyl)porphyrin polymer complex on **Nafion** coated glassy carbon, for oxygen)

IT Electric potential

(formal, of redox couples in **Nafion** coating in water-argon bathing gas)

IT Electrodes

(ref., silver-silver chloride with **Nafion**)

IT 102-54-5, Ferrocene 1271-42-7 1293-87-4 32963-96-5

- (cyclic voltammetry of, using **Nafion** solid electrolyte in absence of contacting electrolyte soln.)
- IT 7440-44-0, Carbon, uses and miscellaneous
(electrode, glassy, coated with **Nafion** intermediate layer and cobalt tetrakis (aminophenyl)porphyrin polymer complex, oxygen catalytic redn. at, in absence of contacting electrolyte soln.)
- IT 7783-90-6, Silver chloride, uses and miscellaneous
(electrode, ref., with silver and **Nafion**)
- IT 7440-22-4, Silver, uses and miscellaneous
(electrode, ref., with silver chloride and **Nafion**)
- IT 31175-20-9
(electrolyte, for voltammetry in the absence of contacting electrolyte soln.)
- IT 13408-62-3, Ferricyanide 13408-63-4 17568-76-2, Octacyanotungstate(3-) 18177-17-8, Octacyanotungstate(4-) 18943-33-4 19052-44-9, Hexaamineruthenium(2+)
(formal potential of redox couple contg., incorporated in **Nafion** coating exposed to argon-water bathing gas)
- IT 107667-67-4
(glassy carbon electrode coated with **Nafion** and, oxygen catalytic redn. at, in absence of contacting electrolyte soln.)
- IT 7782-44-7, Oxygen, reactions
(redn. of, at **Nafion**-glassy carbon electrode coated with cobalt tetrakis(aminophenyl)porphyrin polymeric complex in absence of contacting electrolyte soln.)
- IT 527-61-7, 2,6-Dimethylbenzoquinone
(redn. of, electrochem., incorporated in a **Nafion** coating on glassy carbon electrode exposed to argon-water bathing gas)

L124 ANSWER 33 OF 56 HCA COPYRIGHT 2004 ACS on STN

111:196422 Fluoropolymers for membranes in **electrolysis** cell

for manufacture of sodium hydroxide. Nagasawa, Juji; Kyota, Tooru; Hasebe, Yoshio (Tosoh Corp., Japan). Jpn. Kokai Tokkyo Koho JP 01118537 A2 19890511 Heisei, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1987-275733 19871102.

AB The title fluoropolymers, giving membranes with high current efficiency in the manuf. of NaOH from brine, comprise quaternized **amidation** products of a copolymer contg. SO₂F groups, e.g., F₂C:CF₂-F₂C:CF₂OCF₂CF₂(CF₃)OCF₂CF₂SO₂F copolymer (I), and a [(dialkylamino)alkyl]amine. A fluoropolymer was prepd. by **amidation** of I with Me₂NCH₂CH₂NH₂ during 50 h at 40°, treatment with 1:1 NaOH-MeOH for 30 h at 50°, treatment with 1:4 MeI-DMF for 7 days at 60°, and treatment with 10% LiCl in MeOH for 24 h at 50°.

IT 26654-97-7D, **amidation** products with [(dialkylamino)alkyl]amines, quaternized

(membranes, in brine **electrolysis** cell)

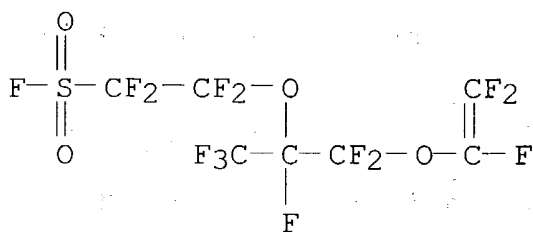
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

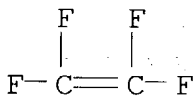
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



IC ICM C08J005-22

ICS B01J047-12; C25B013-08

CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 49

ST fluoropolymer membrane **electrolysis** brine; ammonium membrane **electrolysis** brine; sodium hydroxide manuf **electrolysis**

IT Brines

(electrolysis of, ion-exchanging fluoropolymer membranes for)

IT **Electrolytic** cells(diaphragm, fluoropolymers for, for brine **electrolysis**)

IT Anion exchangers

(membranes, fluoropolymers contg. quaternary ammonium groups, for brine **electrolysis** cells)

IT Fluoropolymers

(quaternary ammonium group-contg., membranes, for brine

electrolysis cell)

IT 1305-62-0, Calcium hydroxide, uses and miscellaneous 1310-65-2,
Lithium hydroxide 1310-73-2, Sodium hydroxide, uses and
miscellaneous

(fluoropolymer membranes treated by, for brine

electrolysis cell)

IT 74-88-4D, quaternization products with fluorosulfonyl derivs. of
fluoropolymers 108-00-9D, amidation products with
fluorosulfonyl derivs. of fluoropolymers 109-55-7D,
amidation products with fluorosulfonyl derivs. of
fluoropolymers **26654-97-7D, amidation** products
with [(dialkylamino)alkyl]amines, quaternized
(membranes, in brine **electrolysis** cell)

L124 ANSWER 34 OF 56 HCA COPYRIGHT 2004 ACS on STN

111:195412 Purification of dipeptide esters (aspartame) via electrolysis
in three-compartment cells. Kurauchi, Yasuhiro; Akazawa, Michihiro;
Harada, Tsuneo; Oyama, Kiyotaka; Tokuda, Akira (Tosoh Corp., Japan).
Eur. Pat. Appl. EP 302478 A1 **19890208**, 30 pp.

DESIGNATED STATES: R: AT, BE, CH, DE, ES, FR, GB, GR, IT, LI, LU,
NL, SE. (English). CODEN: EPXXDW. APPLICATION: EP 1988-112652
19880803. PRIORITY: JP 1987-196296 19870807.

AB Dipeptide esters (specifically aspartame) were purified by
electrolysis in a cell consisting of an anode compartment contg. aq.
electrolyte, a cathode compartment contg. aq. base, and a central
compartment contg. the dipeptide and inorg. acid partitioned by
anion exchange membranes. Thus, a cell as outlined above using a Ni
cathode, a Ti-supported noble metal oxide anode, and fluorinated
anion exchange membranes was charged with 0.5M NaCl in the anode
compartment, 3.5% aq. aspartame contg. .apprx.300 ppm Cl- in the
central compartment, and 0.5M NaOH in the cathode compartment.
Electrolysis at 1.2 A/dn2 and 60° was continued until the pH
in the central compartment exceeded 5.1 to remove 64.9% of the Cl-
anions.

IT **99039-30-2, Nafion 423 123426-92-6**

(electrolytic cell membranes, for removal of chloride from
dipeptide esters)

RN 99039-30-2 HCA

CN Nafion 423 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

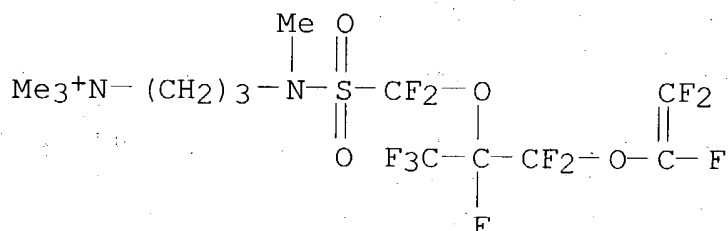
RN 123426-92-6 HCA

CN 3,6-Dioxa-8-thia-9-azadodec-1-en-12-aminium, 1,1,2,4,4,5,7,7-
octafluoro-N,N,N,9-tetramethyl-5-(trifluoromethyl)-, iodide,
8,8-dioxide, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 123426-91-5

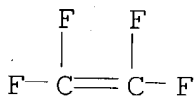
CMF C13 H18 F11 N2 O4 S . I

● I⁻

CM 2

CRN 116-14-3

CMF C2 F4



IC ICM C09K005-06

ICS C07K001-00; B01D013-00

CC 34-3 (Amino Acids, Peptides, and Proteins)

Section cross-reference(s): 17, 72

IT 99039-30-2, Nafion 423 109798-53-0 109798-55-2

109798-57-4 116134-47-5, RAIPORE R-4035 123426-92-6

123426-94-8

(electrolytic cell membranes, for removal of chloride from dipeptide esters)

L124 ANSWER 35 OF 56 HCA COPYRIGHT 2004 ACS on STN

110:162285 Electrode films of porous agarose: the effects of physical structure on electron transport processes. Moran, K. D. (Lawrence Berkeley Lab., Berkeley, CA, USA). Report, LBL-24822; Order No. DE88007366, 162 pp. Avail. NTIS From: Energy Res. Abstr. 1988, 13(14), Abstr. No. 30801 (English) 1988.

AB Potential use of chem. modified electrodes in electrocatalysis has stimulated interest in creation and characterization of electrode films for reagent immobilization. Two highly porous electrocatalyst support matrixes were created with high rates of electron transport. Both are based on immobilization of reagents in agarose gel. In one case, Nafion was impregnated into agarose gel films.

Diffusion of methylviologen in Nafionagarose matrixes are higher than in **Nafion**. In **Nafion**, the diffusion coeff. decreases with increasing methylviologen concn., while in Nafionagarose, the opposite dependence is obsd. The faster rate of electron transport in Nafionagarose films is related to the heterogeneous structure and the coupling of the diffusion pathways. In the second application of agarose gels as an electrode coating material, agarose hydroxyl groups were activated in 1,1'-carbonyldiimidazole and subsequently reacted with **amine derivs.** of electroactive mediators. Electron transport between the electroactive sites in the gel is very rapid (on the order of 10^{-7} cm² s). Interpreting the data in light of the Dahms-Ruff description of electron transport shows that the rate of electron transport through both ferrocene and viologen derivatized gels is limited by the rate of electron self-exchange of the species.

IT 31175-20-9, **Nafion**

(in agarose gel, as porous electrocatalyst support matrixes for electrodes)

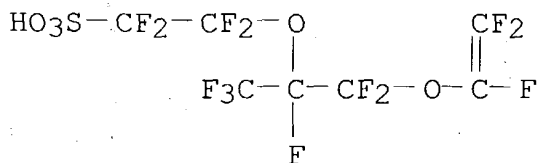
RN 31175-20-9 HCA

CN Ethanesulfonic acid, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 29311-67-9

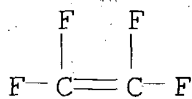
CMF C7 H F13 O5 S



CM 2

CRN 116-14-3

CMF C2 F4



CC 72-2 (Electrochemistry)

Section cross-reference(s): 33, 42

IT Diffusion

(of methylviologen in **Nafion** and Nafionagarose matrixes)

IT 1910-42-5, Methylviologen

(diffusion of, in **Nafion** and Nafionagarose matrixes)

IT 31175-20-9, **Nafion**

(in agarose gel, as porous electrocatalyst support matrixes for electrodes)

L124 ANSWER 36 OF 56 HCA COPYRIGHT 2004 ACS on STN

110:32488 Electrically conductive polymeric composite membranes. Kubo, Izumi (Fuji Electric Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 63161032 A2 19880704 Showa, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1986-314337 19861224.

AB The title membranes are prepd. by forming, in turn, a

cation-exchange membrane and an electrochem. polyimd., elec.

conducting polymer membrane on an electrode and introducing a basic pigment into the membrane by electrolytic redn. Thus, a glass plate

was coated with ITO by sputtering, coated with a **Nafion**

-EtOH compn., dried 1 h at 50°, immersed in an electrolyte

contg. pyrrole while passing an elec. current to form a polypyrrole

layer, and treated with **Rhodamine B** to give a

conducting membrane.

IT 31175-20-9P, **Nafion**

(electrodes contg. doped polypyrrole layer and, manuf. of)

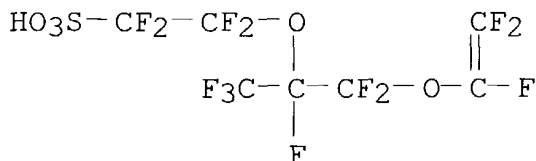
RN 31175-20-9 HCA

CN Ethanesulfonic acid, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 29311-67-9

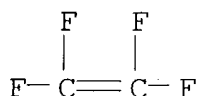
CMF C7 H F13 O5 S



CM 2

CRN 116-14-3

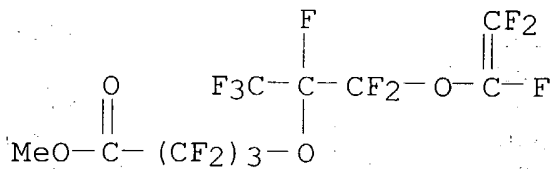
CMF C2 F4



- IC ICM C08J005-22
 CC 76-2 (Electric Phenomena)
 Section cross-reference(s): 38
 IT **31175-20-9P, Nafion** 50926-11-9P, ITO
 (electrodes contg. doped polypyrrole layer and, manuf. of)
- L124 ANSWER 37 OF 56 HCA COPYRIGHT 2004 ACS on STN
 109:193831 **Polymer solid electrolytes**
 containing polyphosphazenes. Matsuki, Toshitsugu; Saiki, Noritsugu
 (Teijin Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 63186766 A2
19880802 Showa, 5 pp. (Japanese). CODEN: JKXXAF.
 APPLICATION: JP 1987-17224 19870129.
- AB The title **electrolytes**, useful in secondary batteries,
 chem. industries, and medical apps., consist of phosphazene polymers
 mainly having structural repeating unit N:P(OR)₂ [R = (substituted)
 aliph., alicycli, arom.; ≥10% of R having ≥1 amide
 group] and metal salts at a mol ratio of repeating unit/metal salt
 .apprx.104-0.2. Thus, a reaction product of 2-aminoethanol and Na
 was refluxed with poly[bis(2-methoxyethoxy)phosphazene] to give a
 polyphosphazene having 21 mol% of 2-methoxyethoxy groups substituted
 with 2-aminoethoxy groups. The prepd. polymer was treated to remove
 HCl, stirred with propionyl chloride for **amidation**, and
 then mixed with LiClO₄ to give a solid **electrolyte** having
 ion cond. 4.2 + 10⁻³ S/cm at 22°.
- IC ICM C08L085-02
 ICS C08K003-10
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38
 ST polyphosphazene metal salt solid **electrolyte**; battery
solid polymer electrolyte
 IT Phosphazene polymers
 (alkoxy, amido, manuf. of solid **electrolytes** from
 lithium perchlorate and, for high ion-cond.)
 IT Phosphazene **polymers**
 (methoxyethoxy propionamidoethoxy, **solid**
electrolytes from lithium perchlorate and, with high
 ion-cond.)
 IT **Electrolytes**
 (solid, polyphosphazene lithium salts)
 IT **Electrolytes**
 (solid, polyphosphazene-lithium salt, for **electrochem.**
 and medical instrument industries)

- IT Batteries, secondary
(solid-**electrolyte**, polyphosphazene-lithium salt as)
- IT 79-03-8D, Propionic acid chloride, reaction products with poly[bis(2-methoxyethoxy)phosphazene] and 2-aminoethanol
141-43-5D, reaction products with poly[bis(2-methoxyethoxy)phosphazene] and propionic acid chloride
26085-02-9D, Poly[nitrilo(dichlorophosphoranylidene)], bis(2-methoxyethoxy) group-contg., reaction products with 2-aminoethanol and propionic acid chloride
(amido, manuf. of solid **electrolytes** from lithium perchlorate and, for high ion-cond.)
- IT 7791-03-9
(solid **electrolytes** from polyphosphazenes and, high ion-cond.)
- L124 ANSWER 38 OF 56 HCA COPYRIGHT 2004 ACS on STN
107:199837 Fluorine-containing anion-exchange membranes. Miyake, Haruhisa; Kaneko, Isamu; Kanba, Motoi (Asahi Glass Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 62045628 A2 19870227
Showa, 6 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1985-183086 19850822.
- AB Anion-exchange membranes having high strength and thickness, useful for **electrolysis**, recovery of metals, etc., are prep'd. by casting solns. of fluoropolymers contg. pendant groups
[O(CF₂CFRO)m]n(CF₂)xR₁ [R = F, CF₃; R₁ = CH₂NR₂R₃, CH₂N+R₂R₃R₄, CH₂NR₅(CH₂)yNR₂R₃, CH₂NR₅(CH₂)yN+R₂R₃R₄, CH₂N+R₅R₆(CH₂)yN+R₂R₃R₄, SO₂NR₅(CH₂)yNR₂R₃, SO₂NR₅(CH₂)yN+R₂R₃R₄; R₂-R₆ = C₁-10 alkyl; m = 0-20; n = 0-1; x, y = 1-5]. A copolymer of F₂C:CF₂ and F₂C:CFOCF₂CF(CF₃)O(CF₂)₃CO₂Me was **amidated** with Me₂NH in DMF at 60°, mixed with diglyme contg. NaBH₄, mixed with diglyme contg. BF₃-Et₂O complex at 0°, heated at 100° to give the amine, heated with MeOH contg. MeI at 60°, and heated with MeOH contg. LiCl at 60° to give a resin which was ground, dissolved in MeOH at 60°, and cast on glass to give a 100-μ membrane having elec. resistance (in 0.5M NaCl) 1.5 Ω.cm and transport no. (0.5M NaCl/1.0M NaCl) 0.90.
- IT 62361-03-9D, amine and ammonium derivs. 66687-22-7D
, amine and ammonium derivs.
(anion-exchange membranes, for **electrolysis** and metal recovery)
- RN 62361-03-9 HCA
- CN Butanoic acid, 4-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-2,2,3,3,4,4-hexafluoro-, methyl ester, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)
- CM 1
- CRN 62361-02-8

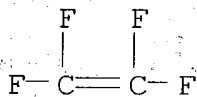
CMF C10 H3 F15 O4



CM 2

CRN 116-14-3

CMF C2 F4



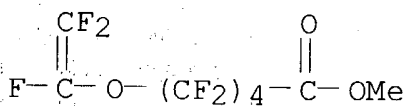
RN 66687-22-7 HCA

CRN Pentanoic acid, 2,2,3,3,4,4,5,5-octafluoro-5-[(trifluoroethenyl)oxy]-
 , methyl ester, polymer with tetrafluoroethene (9CI) (CA INDEX
 NAME)

CM 1

CRN 19190-58-0

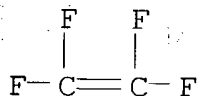
CMF C8 H3 F11 O3



CM 2

CRN 116-14-3

CMF C2 F4



IC ICM C08J005-22

CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 60

ST fluoropolymer amine anion exchanger; ammonium fluoropolymer anion exchanger; elec cond fluoropolymer membrane; membrane anion exchanger fluoropolymer; **electrolysis** membrane fluoropolymer

IT Brines

(**electrolysis** of, cells for, fluoropolymer diaphragms for)

IT **Electrolytic** cells

(diaphragm, fluoropolymers with amino and ammonium groups for)

IT **62361-03-9D**, amine and ammonium derivs. **66687-22-7D**

, amine and ammonium derivs.

(anion-exchange membranes, for **electrolysis** and metal recovery)

L124 ANSWER 39 OF 56 HCA COPYRIGHT 2004 ACS on STN

105:202470 Selectivity and sensitivity improvements at perfluorinated ionomer/cellulose acetate bilayer electrodes. Wang, Joseph; Tuzhi, Peng (Dep. Chem., New Mexico State Univ., Las Cruces, NM, 88003, USA). Analytical Chemistry, 58(14), 3257-61 (English) **1986**. CODEN: ANCHAM. ISSN: 0003-2700.

AB A new type of bilayer modified electrode with an inner duPont's **Nafion** perfluorinated film and an outer cellulose acetate layer is described. Base hydrolysis of the outer cellulosic layer is used to manipulate access toward the inner perfluorinated film. As a result, such assembly displays properties superior to those of the 2 components alone. In particular, substantial improvement of the selectivity of sensors based on perfluorinated films is obtained. For example, the electrode measures concn. changes of dopamine without responding to concomitant changes in epinephrine or norepinephrine levels. The bilayer assembly offers the addnl. advantage of enhanced sensitivity. Cyclic voltammetry is used to evaluate the response characteristics and anal. utility. The concept of bifunctional electrode coating, consisting of 2 different permselective overlaid films, might be of general utility in electroanal.

IT **31175-20-9**

(glassy carbon electrode modified with bilayer coating of cellulose acetate and, for voltammetric anal.)

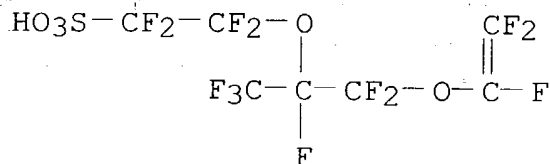
RN **31175-20-9** HCA

CN Ethanesulfonic acid, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 29311-67-9

CMF C7 H F13 O5 S



CM 2

CRN 116-14-3

CMF C2 F4



- CC 80-2 (Organic Analytical Chemistry);
Section cross-reference(s): 72
- ST bilayer modified electrode analysis; **Nafion** cellulose acetate modified electrode; base hydrolysis cellulose acetate; **dopamine** detection modified electrode; voltammetry; bilayer modified electrode
- IT Hydrolysis
(base, of cellulose acetate in **Nafion**-cellulose acetate bilayer-modified glassy carbon electrode for selectivity enhancement)
- IT Voltammetry
(cyclic, glassy carbon electrode modified with **Nafion**-cellulose acetate bilayer coating for)
- IT Electrodes
(voltammetric, glassy carbon modified with **Nafion**-cellulose acetate bilayer coating as)
- IT 51-61-6, analysis
(detection of, in presence of epinephrine and norepinephrine and serotonin, glassy carbon electrode modified with **Nafion**-cellulose acetate bilayer coating for voltammetric)
- IT 50-67-9, uses and miscellaneous 51-41-2 51-43-4
(**dopamine** detection in presence of, by voltammetry with glassy carbon electrode modified with **Nafion**-cellulose acetate bilayer coating)
- IT 9004-35-7
(glassy carbon electrode modified with bilayer coating of **Nafion** and, for voltammetric anal.)
- IT 31175-20-9
(glassy carbon electrode modified with bilayer coating of

cellulose acetate and, for voltammetric anal.)

IT 7440-44-0, uses and miscellaneous
(glassy, electrode, modified with **Nafion**-cellulose
acetate bilayer coating, for voltammetric anal.)

L124 ANSWER 40 OF 56 HCA COPYRIGHT 2004 ACS on STN

105:173314 Fluoropolymers containing pendant quaternary ammonium
compounds. Matsui, Kiyohide; Kikuchi, Yoshiyuki; Hiyama, Tamejiro;
Kyota, Toru; Kondo, Sei; Akimoto, Akira; Kyota, Tooru; Watanabe,
Hiroyuki (Toyo Soda Mfg. Co., Ltd., Japan; Sagami Chemical Research
Center). Jpn. Kokai Tokkyo Koho JP 61098708 A2 **19860517**
Showa, 28 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP
1984-127565 19840622.

AB A durable anion-exchange resin is prep'd. from a fluoropolymer with
pendant groups contg. hydrocarbon end groups contg. ≥ 3 N, at
least one of which is quaternized. Thus, a 125- μ **Nafion**
125 (7.6:1 CF₂:CF₂-CF₂:CFOCF₂CF₂CF₃(CF₂)₂SO₂F) film was carboxylated
by treating with SO₂Cl₂ and HI to convert O(CF₂)₂SO₂F end group to
OCF₂CO₂H. The film was then treated with N-(aminoethyl)piperazine
in MeCN contg. Et₃N and Me₃SiCl to form amide group, at .apprx.100%
yield, treated with NaBH₄ to reduce carbonyl groups at .apprx.85%
yield, and quaternized with Me₃I, and treated with 10% LiCl soln. in
MeOH to give a film contg. quaternary ammonium chloride end groups
exhibiting resistance 3.2 Ω -cm² in 0.5N aq. NaCl at 25°
and transport no. 0.86 between solns. of 0.5N and 2.0N aq. NaCl
soln., withstanding 100 h of immersion in 50°
ethylenediamine.

IT **63863-44-5D**, hydrolyzed, **amidized** with polyamines,
hydrogenated, and quaternized **65506-90-3D**, carboxylated,
amidized with polyamines, hydrogenated, and quaternized
(films, anion-exchange resins, durable)

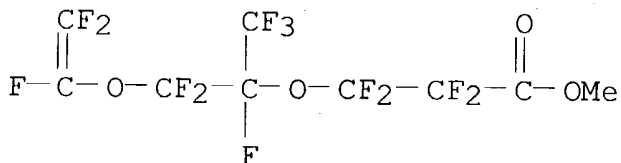
RN 63863-44-5 HCA

CN Propanoic acid, 3-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-
tetrafluoroethoxy]-2,2,3,3-tetrafluoro-, methyl ester, polymer with
tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 63863-43-4

CMF C9 H3 F13 O4



CM 2

CRN 116-14-3

CMF C2 F4



RN 65506-90-3 HCA

CN Nafion 125 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 26654-97-7D, carboxylated, amidized with
polyamines, quaternized
(tubes, anion-exchange resins, durable)

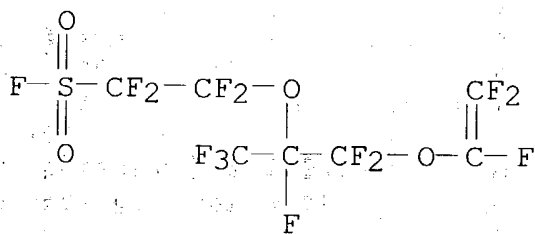
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl
]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with
tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

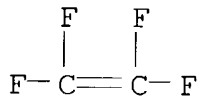
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



IC ICM C08F214-26

- ICI C08F214-26, C08F226-02; C08F214-26, C08F216-14
CC 35-8 (Chemistry of Synthetic High Polymers)
Section cross-reference(s): 48
IT 10563-29-8D, carboxylated, **amidized** with polyamines,
quaternized
(films or tubes, anion-exchange resins, durable)
IT 112-24-3D, fluoropolymers contg. carboxy end groups on side chains
treated with hydrogenated, quaternized 140-31-8D, fluoropolymers
contg. carboxy end groups on side chains treated with hydrogenated,
quaternized 6711-48-4D, fluoropolymers contg. carboxy end groups
on side chains treated with hydrogenated, quaternized 24229-48-9D,
fluoropolymers contg. carboxy end groups on side chains treated with
hydrogenated, quaternized **63863-44-5D**, hydrolyzed,
amidized with polyamines, hydrogenated, and quaternized
65506-90-3D, carboxylated, **amidized** with
polyamines, hydrogenated, and quaternized
(films, anion-exchange resins, durable)
IT **26654-97-7D**, carboxylated, **amidized** with
polyamines, quaternized
(tubes, anion-exchange resins, durable)

L124 ANSWER 41 OF 56 HCA COPYRIGHT 2004 ACS on STN

105:134785 Novel anion exchange membranes having fluorocarbon backbone:
preparation and stability. Matsui, Kiyohide; Tobita, Etsuko;
Sugimoto, Kikuo; Kondo, Kiyoshi; Seita, Toru; Akimoto, Akira (Sagami
Chem. Res. Cent., Sagami, 229, Japan). Journal of Applied
Polymer Science, 32(3), 4137-43 (English) 1986. CODEN:
JAPNAB. ISSN: 0021-8995.

AB Anion-exchange membranes with excellent durability were prep'd. by
chem. modification of **Nafions**. The membranes were first
converted to carboxamides and the CO groups were reduced to CH₂
groups followed by quaternization with alkyl iodide. The elec.
resistance of the resulting membranes depended on the equiv. wt. of
the starting membranes. The membranes had excellent stability
toward org. solvents, oxidizing agents, acids, etc. The membranes
were stable in aq. satd. Cl₂ soln. at 60° for 1000 h.

IT 107-10-8DP, quaternized **Nafion** derivs.
65506-90-3DP, quaternary ammonium derivs.
66796-30-3DP, quaternary ammonium derivs.
74238-91-8DP, quaternary ammonium derivs.
(membranes, anion-exchange, prepn. and stability of)

RN 107-10-8 HCA

CN 1-Propanamine (9CI) (CA INDEX NAME)

H₃C-CH₂-CH₂-NH₂

RN 65506-90-3 HCA

CN Nafion 125 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 66796-30-3 HCA

CN Nafion 117 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 74238-91-8 HCA

CN Nafion 415 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 37-5 (Plastics Manufacture and Processing)

Section cross-reference(s): 72

ST anion exchanger **Nafion** membrane

IT Electrolytic cells

(diaphragm, anion-exchange, from modified **Nafions**)

IT Anion exchangers

(membranes, modified **Nafion**, prepn. and stability of)

IT 62-53-3DP, quaternized **Nafion** derivs. 107-10-8DP

, quaternized **Nafion** derivs. 109-89-7DP, quaternized

Nafion derivs. 123-75-1DP, quaternized **Nafion**

derivs. 65506-90-3DP, quaternary ammonium derivs.

66796-30-3DP, quaternary ammonium derivs.

74238-91-8DP, quaternary ammonium derivs.

(membranes, anion-exchange, prepn. and stability of)

L124 ANSWER 42 OF 56 HCA COPYRIGHT 2004 ACS on STN

104:97836 Polymer films on electrodes. 20. An ESR study of several spin probes incorporated into **Nafion**. Kaifer, Angel E.;

Bard, Allen J. (Dep. Chem., Univ. Texas, Austin, TX, 78712, USA).

Journal of Physical Chemistry, 90(5), 868-73 (English) 1986

CODEN: JPCHAX. ISSN: 0022-3654.

AB The oxidative electrochem. of protonated 4-amino-2,2,6,6-tetramethyl-1-piperidinyloxy (Tempamine, TP) was surveyed with Pt/**Nafion**

modified electrodes. Protonated TP was shown to incorporate into

Nafion films at pH <9. Its oxidn. is a reversible,

1-electron process occurring at $E_{1/2} = 0.54$ V vs. SCE on Pt/

Nafion electrodes (.apprx.120 mV less pos. than $E_{1/2}$ on bare

Pt) and independent of the pH in the range 4-8. The ESR spectrum of

Nafion-confined TP showed that the rotational correlation

time was in the slow tumbling region and was estd. to be $1.2 +$

10^{-8} s. This reveals an unusual anchoring effect by **Nafion**

which was not obsd. previously. The ESR spectra of some addn.

Nafion-confined spin probes such as vanadyl (VO_2^+), Mn(II),

and the cation radical of N,N,N',N'-tetramethyl-1,4-phenylenediamine

(TMPD) were also surveyed. The results indicate that the motion of

a given cation within **Nafion** is detd. by the nature of the

cation itself.

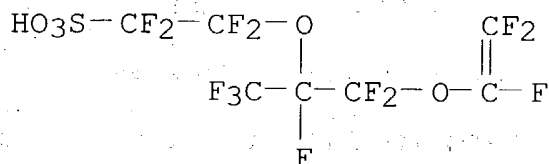
IT 31175-20-9

(platinum electrode modified with, for ESR studies, spin probe in relation to)

RN 31175-20-9 HCA
 CN Ethanesulfonic acid, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

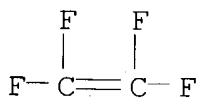
CM 1

CRN 29311-67-9
 CMF C7 H F13 O5 S



CM 2

CRN 116-14-3
 CMF C2 F4



CC 72-2 (Electrochemistry)

Section cross-reference(s): 65, 77

ST **Nafion** modified electrode ESR **Tempamine**

;manganous ion ESR **Nafion** electrode; vanadyl ion ESR

Nafion electrode; methylphenylenediamine ESR **Nafion**

electrode; phenylenediamine methyl ESR **Nafion** electrode;

oxidn aminomethylpiperidinyloxy **Nafion** coating anode; spin

probe nitroxide **Nafion** electrode

IT Electrodes

(**Nafion**-modified platinum, with incorporated protonated aminotetramethylpiperidinyloxy, spin probe in relation to)

IT Electron spin resonance

(of protonated aminotetramethylpiperidinyloxy incorporated in

Nafion modified platinum electrodes)

IT Oxidation, electrochemical

(of protonated aminotetramethylpiperidinyloxy, incorporated in **Nafion**-modified platinum anodes)

IT 7439-96-5, uses and miscellaneous 20644-97-7 34527-55-4

(ESR of, incorporated into **Nafion**-modified platinum electrodes, spin probe in relation to)

- IT 7440-06-4, uses and miscellaneous
(electrodes, **Nafion**-modified, for ESR studies, spin
probe in relation to)
- IT 14691-88-4D, protonated
(oxidative electrochem. of, on **Nafion**-modified platinum
electrodes)
- IT 31175-20-9
(platinum electrode modified with, for ESR studies, spin probe in
relation to)

L124 ANSWER 43 OF 56 HCA COPYRIGHT 2004 ACS on STN
103:88821 Nitrogen-containing fluorocarbon polymers. (Toyo Soda Mfg.
Co., Ltd., Japan; Sagami Chemical Research Center). Jpn. Kokai
Tokkyo Koho JP 60084312 A2 19850513 Showa, 32 pp.
(Japanese). CODEN: JKXXAF. APPLICATION: JP 1983-183020 19831003.

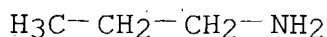
AB Polymers contg. perfluorocarbon main chains and pendant chains
terminated with amide groups are prep'd., which are intermediates for
manuf. of durable anion exchangers. Thus, a **Nafion** 114
film contg. OCF₂CFCF₃OCF₂CF₂SO₂F pendant chains was converted to
OCF₂CFCF₃OCF₂CO₂Na and OCF₂CFCF₃OCF₂CO₂Me and treated with Me₂NH to
give a film contg. OCF₂CFCF₃OCF₂CONMe₂ and not dyeable with crystal
violet or cresol red.

IT 107-10-8D, reaction products with perfluorocarbon polymer
ester derivs. 7664-41-7D, reaction products with
perfluorocarbon polymer ester derivs. 65506-90-3D, ester
derivs.

(intermediates, for anion exchangers)

RN 107-10-8 HCA

CN 1-Propanamine (9CI) (CA INDEX NAME)



RN 7664-41-7 HCA

CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH₃

RN 65506-90-3 HCA

CN Nafion 125 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC ICM C08F214-26

ICS C08F008-30

ICA B01J041-14; C08J005-22

ICI C08F214-26, C08F216-14

CC 38-3 (Plastics Fabrication and Uses)

IT 62-53-3D, reaction products with perfluorocarbon polymer ester

derivs. 107-10-8D, reaction products with perfluorocarbon polymer ester derivs. 109-89-7D, reaction products with perfluorocarbon polymer ester derivs. 123-75-1D, reaction products with perfluorocarbon polymer ester derivs. 124-40-3D, reaction products with perfluorocarbon polymer ester derivs. 141-43-5D, reaction products with perfluorocarbon polymer carboxylic acid derivs. 7664-41-7D, reaction products with perfluorocarbon polymer ester derivs. 26654-97-7D, amine derivs

. 63863-44-5D, amine derivs.

65506-90-3D, ester derivs.

(intermediates, for anion exchangers)

L124 ANSWER 44 OF 56 HCA COPYRIGHT 2004 ACS on STN

103:88820 Ammonium-type polymers. (Toyo Soda Mfg. Co., Ltd., Japan; Sagami Chemical Research Center). Jpn. Kokai Tokkyo Koho JP 60084314 A2 19850513 Showa, 32 pp. (Japanese). CODEN:

JKXXAF. APPLICATION: JP 1983-192474 19831017.

AB Polymers contg. perfluorocarbon main chains and pendant chains terminated with amine groups are alkylated to prep. durable anion exchangers. Thus, a Nafion 114 film contg.

OCF₂CF₂CF₃OCF₂CF₂SO₂F pendant chains was converted to OCF₂CF₂CF₃OCF₂CO₂Na and OCF₂CF₂CF₃OCF₂CO₂Me, treated with Me₂NH to give amide pendant chains, reduced, and methylated to prep. an anion exchanger having exchange capacity 0.82 mequiv/g, elec. resistance 3.3 Ω/cm², and transport no. 0.87. These values were not changed after the anion exchanger was immersed 1000 h in water satd. with Cl at 60°.

IT 107-10-8D, reaction products with perfluorocarbon polymer ester derivs. 7664-41-7D, reaction products with perfluorocarbon polymer ester derivs.

(intermediates, for anion exchangers)

RN 107-10-8 HCA

CN 1-Propanamine (9CI) (CA INDEX NAME)

H₃C-CH₂-CH₂-NH₂

RN 7664-41-7 HCA

CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH₃

IC ICM C08F214-26

ICS B01J041-14; C08F008-02; C08F008-32

CC 38-3 (Plastics Fabrication and Uses)

IT 62-53-3D, reaction products with perfluorocarbon polymer ester derivs. 107-10-8D, reaction products with perfluorocarbon

polymer ester derivs. 109-89-7D, reaction products with perfluorocarbon polymer ester derivs. 123-75-1D, reaction products with perfluorocarbon polymer ester derivs. 124-40-3D, reaction products with perfluorocarbon polymer ester derivs. 141-43-5D, reaction products with perfluorocarbon polymer carboxylic acid derivs. **7664-41-7D**, reaction products with perfluorocarbon polymer ester derivs. 26654-97-7D, ester derivs. (intermediates, for anion exchangers)

L124 ANSWER 45 OF 56 HCA COPYRIGHT 2004 ACS on STN

102:62717 Tubular anion exchangers from perfluoropolymers. (Toyo Soda Mfg. Co., Ltd., Japan; Sagami Chemical Research Center). Jpn. Kokai Tokkyo Koho JP 59155435 A2 **19840904** Showa, 8 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1983-29246 19830225.

AB A durable tubular anion exchange resin is prepd. from a perfluoropolymer contg. a quaternary ammonium salt group. Thus, a tubular copolymer of CF₂:CF₂ and CF₂:CFOCF₂CF(CF₃)O(CF₂)₂SO₂F (inner diam. 0.625 mm, outer diam. 0.875 mm, SO₃H exchange capacity 0.92 mequiv/g-resin) was sulfochlorinated, oxidized to form a carboxylic acid group, acid chlorinated, **amidized** with dimethylamine, reduced with NaBH₄ and BF₃-ether complex, and alkylated with MeI to introduce a quaternary ammonium chloride group, giving an anion exchanger with capacity 0.88 mequiv/g-resin.

IT **26654-97-7D**, quaternary ammonium derivs. (tubes, anion exchange membranes contg.)

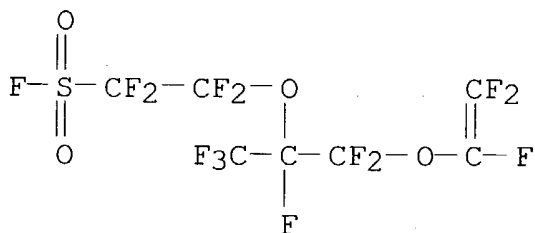
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

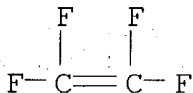
CMF C7 F14 O4 S



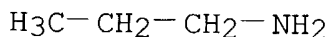
CM 2

CRN 116-14-3

CMF C2 F4



- IC C08J005-22; C25B013-08
 CC 35-8 (Chemistry of Synthetic High Polymers)
 IT 109-01-3D, reaction products with sulfonated carboxylated fluoropolymers 124-40-3D, reaction products with sulfonated carboxylated fluoropolymers 142-25-6D, reaction products with sulfonated carboxylated fluoropolymers **26654-97-7D**, quaternary ammonium derivs.
 (tubes, anion exchange membranes contg.)
- L124 ANSWER 46 OF 56 HCA COPYRIGHT 2004 ACS on STN
 101:172658 Fluorocarbon polymers. Matsui, Kiyohide; Kikuchi, Yoshiyuki; Hiyama, Tamejiro; Tobita, Etsuko; Kondo, Kiyoshi; Akimoto, Akira; Seita, Toru; Watanabe, Horiyuki (Toyo Soda Mfg. Co., Ltd., Japan; Sagami Chemical Research Center). Eur. Pat. Appl. EP 113481 A2 **19840718**, 184 pp. DESIGNATED STATES: R: BE, CH, DE, FR, GB, IT, LI, NL, SE. (English). CODEN: EPXXDW. APPLICATION: EP 1983-113140 19831227. PRIORITY: JP 1982-227443 19821228; JP 1983-116062 19830629; JP 1983-192473 19831017.
- AB Anion exchangers having good resistance to oxidn. by Cl consist of a polymer having a perfluorocarbon main chain and a pendant quaternary ammonium-terminated chain. For example, **Nafion 114**, prepd. from F2C:CF2 and CF2:CFCF2CF(CF3)OCF2CF2SO2F, was quaternized in a multistep process to give an anion exchange membrane having anion exchange capacity 0.82 mequiv/g dry membrane, elec. resistance 3.3 Ω -cm², transport no. 0.87, and no change of these values after immersion in satd. aq. Cl soln. at 60° for 1000 h.
- IT **107-10-8D**, fluoropolymer quaternary ammonium derivs. **7664-41-7D**, fluoropolymer quaternary ammonium derivs. **65506-90-3D**, quaternary ammonium derivs. **71538-47-1D**, quaternary ammonium derivs. **74238-91-8D**, quaternary ammonium derivs. **74350-12-2D**, quaternary ammonium derivs.
 (anion exchanger membranes, oxidn.-resistant)
- RN 107-10-8 HCA
 CN 1-Propanamine (9CI) (CA INDEX NAME)



- RN 7664-41-7 HCA
 CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH3

RN 65506-90-3 HCA
CN Nafion 125 (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
RN 71538-47-1 HCA
CN Nafion 114 (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
RN 74238-91-8 HCA
CN Nafion 415 (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
RN 74350-12-2 HCA
CN Nafion 511 (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
IC C08F008-44; C08F014-18; C08J005-22
CC 38-3 (Plastics Fabrication and Uses)
Section cross-reference(s): 35
ST anion exchange quaternized fluoropolymer membrane; **Nafion**
quaternized membrane anion exchanger; oxidn chlorine resistant anion
exchanger
IT 62-53-3D, fluoropolymer quaternary ammonium derivs. 104-78-9D,
fluoropolymer quaternary ammonium derivs. **107-10-8D**,
fluoropolymer quaternary ammonium derivs. 108-00-9D, fluoropolymer
quaternary ammonium derivs. 109-01-3D, fluoropolymer quaternary
ammonium derivs. 109-55-7D, fluoropolymer quaternary ammonium
derivs. 109-89-7D, fluoropolymer quaternary ammonium derivs.
111-33-1D, fluoropolymer quaternary ammonium derivs. 123-75-1D,
fluoropolymer quaternary ammonium derivs. 124-40-3D, fluoropolymer
quaternary ammonium derivs. 142-25-6D, fluoropolymer quaternary
ammonium derivs. 3529-10-0D, fluoropolymer quaternary ammonium
derivs. 4543-96-8D, fluoropolymer quaternary ammonium derivs.
7154-73-6D, fluoropolymer quaternary ammonium derivs.
7664-41-7D, fluoropolymer quaternary ammonium derivs.
25560-00-3D, fluoropolymer quaternary ammonium derivs.
26654-97-7D, quaternary ammonium derivs. 27001-68-9D,
fluoropolymer quaternary ammonium derivs. 63863-44-5D, quaternary
ammonium derivs. **65506-90-3D**, quaternary ammonium derivs.
71538-47-1D, quaternary ammonium derivs. **74238-91-8D**
, quaternary ammonium derivs. **74350-12-2D**, quaternary
ammonium derivs.
(anion exchanger membranes, oxidn.-resistant)

L124 ANSWER 47 OF 56 HCA COPYRIGHT 2004 ACS on STN
99:180882 Determination of nitrogen compounds in gas. (Kimoto Electric
Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 58085155 A2
19830521 Showa, 5 pp. (Japanese). CODEN: JKXXAF.
APPLICATION: JP 1981-182631 19811114.

AB The total-N and **NH3** are detd. in air or waste gases by a chemiluminescence app. The app. det. the total-N by converting all of the N compds. to NO, which is then reacted with O3 to det. the chemiluminescence. Another sample is then passed through **Nafion** ion exchange to remove **NH3** and **amines**, and then **treated** as above. The difference of the 2 reading is equiv. to **NH3-N** components.

IT **7664-41-7**, analysis
(detn. of total, in air and flue gases and waste gases by conversion to nitric oxide and chemiluminescence)

RN **7664-41-7** HCA

CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH3

IC G01N031-06

CC 59-1 (Air Pollution and Industrial Hygiene)
Section cross-reference(s): 79

ST nitrogen total detn chemiluminescence air; **ammonia** detn waste gas

IT Air analysis

Waste gases

(total-nitrogen and **ammonia**-nitrogen detn. in, by chemiluminescence)

IT **7664-41-7**, analysis 7727-37-9, analysis
(detn. of total, in air and flue gases and waste gases by conversion to nitric oxide and chemiluminescence)

L124 ANSWER 48 OF 56 HCA COPYRIGHT 2004 ACS on STN

99:58201 Determination of sulfur dioxide. (Kimoto Electric Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 58044344 A2 **19830315**
Showa, 3 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP
1981-142800 19810909.

AB A sample gas is treated with a strongly acidic ion exchanger to remove **NH3**, and then the gas is scrubbed in a soln. and the elec. cond. of the resulting soln. is detd. to est. the SO2 concn. in the sample. Thus, a gas sample contg. SO2 and **NH3** was **treated** with **Nafion** [**31175-20-9**], and then scrubbed in a 0.01 mM H2SO4 soln. contg. 0.006% H2O2. A sample contg. 40 ppb SO2 showed 7.12 μ S/cm, and 6.02 μ S/cm for sample contg. 40 ppb SO2 and 50 ppb **NH3**.

IT **31175-20-9**

(for ammonia removal from gas samples in sulfur dioxide detn.)

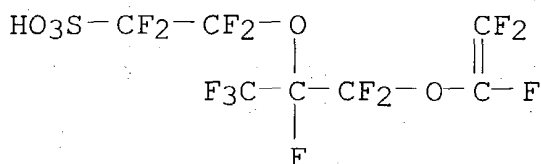
RN **31175-20-9** HCA

CN Ethanesulfonic acid, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 29311-67-9

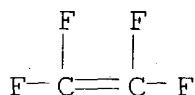
CMF C7 H F13 O5 S



CM 2

CRN 116-14-3

CMF C2 F4



IC G01N031-06; G01N027-06

CC 59-1 (Air Pollution and Industrial Hygiene)

Section cross-reference(s): 79

IT 31175-20-9

(for ammonia removal from gas samples in sulfur dioxide detn.)

L124 ANSWER 49 OF 56 HCA COPYRIGHT 2004 ACS on STN

97:128231 Thermal crosslinking of a chemically-modified ionomer.

Covitch, M. J.; Lowry, S. R.; Gray, C. L.; Blackford, B. (T. R. Evans Res. Cent., Diamond Shamrock Corp., Painesville, OH, 44077, USA). Polymer Science and Technology (Plenum), 16(Polym. Sep. Media), 257-67 (English) 1982. CODEN: POSTB5. ISSN: 0093-6286.

AB **Nafion** 117 perfluorosulfonic acid ionomer membranes were chlorinated, **treated** with **ethylenediamine**, then heated and examd. for evidence of crosslinking. When chlorinated membranes 0.18-mm-thick were immersed in 95% aq. ethylenediamine for 4 h, IR spectra and gravimetric measurements showed essentially complete conversion of sulfonyl chloride functional groups to sulfonamide monoamine. When these treated membranes were heated to 115°, **NH3(g)** was evolved. Gravimetric, swelling, and dynamic modulus measurements on the heat-treated membranes indicated increased crosslinking, apparently by condensation of primary amino groups to form secondary amines, although this could

not be directly confirmed by IR spectroscopy. Possible crosslinking reaction mechanisms were discussed.

IT 66796-30-3D, chlorinated, reaction products with ethylenediamine

(crosslinking of, thermal)

RN 66796-30-3 HCA

CN Nafion 117 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 35-8 (Chemistry of Synthetic High Polymers)

ST crosslinking Nafion amide membrane; perfluorosulfonamide copolymer membrane crosslinking; ethylenediamine modified Nafion membrane

IT Crosslinking

(thermal, of ethylenediamine-modified

Nafion pereflluorosulfonic acid copolymer membranes, mechanism of)

IT 107-15-3D, reaction products with perfluorosulfonic acid chloride copolymer membranes 66796-30-3D, chlorinated, reaction products with ethylenediamine 81666-34-4D, reaction products with ethylenediamine (crosslinking of, thermal)

L124 ANSWER 50 OF 56 HCA COPYRIGHT 2004 ACS on STN

95:123027 Cation-exchanging membrane for brine electrolysis. (Tokuyama Soda Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 56038490 19810413 Showa, 19 pp. (Japanese). CODEN: JKXXAF.

APPLICATION: JP 1980-72717 19800602.

AB The title membranes are made by the fixation of cation-exchangeable groups to a high mol. wt. base. Thus, Nafion XR 480 was treated with SO₂Cl/CCl₄ to affix SO₂Cl groups to its surface. The membrane was rinsed in CCl₄ and then soaked in various solns., e.g. PhNH₂, and soaked in aq. NaOH before using in brine electrolysis.

IT 75-31-0, uses and miscellaneous

(cation-exchange membrane treated with, for brine electrolysis)

RN 75-31-0 HCA

CN 2-Propanamine (9CI) (CA INDEX NAME)

NH₂

H₃C-CH-CH₃

IT 57407-37-1

(membranes, treated with sulfonyl chloride amides)

RN 57407-37-1 HCA

CN Nafion XR 480 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC C25B013-08; B01J039-08; C08J005-22; C25B001-46

- CC 72-10 (Electrochemistry)
Section cross-reference(s): 49
- ST cation exchanging membrane brine electrolysis; **Nafion**
membrane treatment brine electrolysis; **amine**
treatment cation exchange membrane
- IT 62-53-3, uses and miscellaneous 67-56-1, uses and miscellaneous
75-31-0, uses and miscellaneous 97-88-1 100-43-6
107-15-3, uses and miscellaneous 112-24-3 119-61-9, uses and
miscellaneous 1321-74-0, uses and miscellaneous 7791-25-5
(cation-exchange membrane treated with, for brine electrolysis)
- IT 57407-37-1
(membranes, treated with sulfonyl chloride amides)

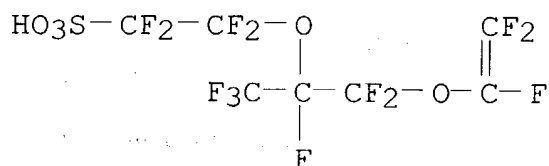
L124 ANSWER 51 OF 56 HCA COPYRIGHT 2004 ACS on STN

- 93:194470 Coated perfluorosulfonic acid resin membranes. Kadija, Igor
V.; Woodard, Kenneth E., Jr. (Olin Corp., USA). U.S. US 4217198
19800812, 4 pp. (English). CODEN: USXXAM. APPLICATION: US
1979-23065 19790323.
- AB A cation-exchanging membrane comprised of a film of
perfluorosulfonic acid resin coated with a fluoroalkyl resin is
described for use in a cell for electrolysis of ionizable chem.
compds. such as brines. Fluoroalkyl resins such as water repellents
are coated on resins such as perfluoro (3,6-dioxa-4-methyl-7-
octenesulfonyl fluoride). Thus, a perfluorosulfonic acid resin (**Nafion**)
modified with ethylenediamine
was given 2 coats of a water repellent material (3M Co. Scotchguard
FC-4101-16) with the sheet dried between each coat at 100°
for .apprx.3 min. After the final drying, the coated membrane was
soaked for 2 h in 20% NaOH soln. at 85°. When used as a
membrane in brine electrolysis over a 10-day period, NaOH 350-370
and NaCl 5-7 g/L was produced at 83-89% current efficiency at a cell
potential of 3.5-3.7 V and power consumption of 2770-2980 kW-h/ton
of Cl produced.
- IT 31175-20-9
(coatings on, of fluoroalkyl resin, for cation-exchanging
membrane, for brine electrolysis)
- RN 31175-20-9 HCA
- CN Ethanesulfonic acid, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-
1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with
tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 29311-67-9

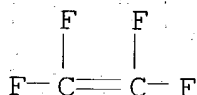
CMF C7 H F13 O5 S



CM 2

CRN 116-14-3

CMF C2 F4



IC C25C007-04; B05D001-02; C25B013-08

NCL 204252000

CC 72-10 (Electrochemistry)

Section cross-reference(s): 37, 49

IT 107-15-3D, reaction products with perfluorosulfonic acid resins
31175-20-9(coatings on, of fluoroalkyl resin, for cation-exchanging
membrane, for brine electrolysis)

L124 ANSWER 52 OF 56 HCA COPYRIGHT 2004 ACS on STN

92:188292 Electrolysis of aqueous alkali metal halide solutions.

Lohrberg, Karl (Metallgesellschaft A.-G., Fed. Rep. Ger.). Ger.

Offen. DE 2837313 19800313, 12 pp. (German). CODEN:

GWXXBX. APPLICATION: DE 1978-2837313 19780826.

AB In this membrane cell, electrolysis proceeds at a pH >1 in the anode section whereby the brine is conducted through the anode section as well as the zone for concg. with the alkali halide and for pH adjustment; a part of the current is applied to the concd. soln. at a higher temp. at a pH <1 and then the pH is raised to a value of 1 to 6. The electrolysis was done in a double membrane cell with a steel cathode and a Ti anode at 3.8 V. **Ethylenediamine-modified Nafion** membranes were used. A brine contg. 310 g/L NaCl at pH 1.7 and 85° was admitted to the anode section. After a dwell-time of the anolyte in the anode chamber of 1 h a drop in NaCl concn. of 25 g/L took place. Within this time 2 g/L of HClO₃ (calcd. as NaClO₃) formed. The NaCl was further increased in concn. and more HClO₃ was produced to a 22 g/L concn. (as NaClO₃).

IT 31175-20-9

(membranes, **ethylenediamine-modified**, for
brine electrolysis)

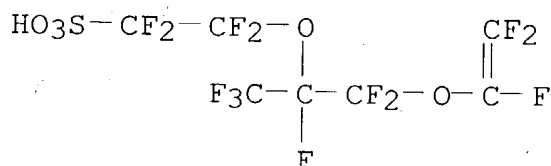
RN 31175-20-9 HCA

CN Ethanesulfonic acid, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-
1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with
tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 29311-67-9

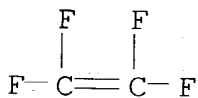
CMF C7 H F13 O5 S



CM 2

CRN 116-14-3

CMF C2 F4



IC C25B001-46

CC 72-10 (Electrochemistry)

Section cross-reference(s): 49

IT 107-15-3, uses and miscellaneous

(**Nafion** membranes modified with, for brine
electrolysis)

IT 31175-20-9

(membranes, **ethylenediamine-modified**, for
brine electrolysis)

L124 ANSWER 53 OF 56 HCA COPYRIGHT 2004 ACS on STN

92:155066 Sodium ion diffusion in **Nafion** ion exchange

membranes. Yeager, H. L.; Kipling, B.; Dotson, R. L. (Dep. Chem.,
Univ. Calgary, Calgary, AB, T2N 1N4, Can.). Journal of the
Electrochemical Society, 127(2), 303-7 (English) 1980.

CODEN: JESOAN. ISSN: 0013-4651.

AB Development of membrane chlor-alkali cells during this past decade
represents a major advancement for com. electrochem. technol. Chem.

engineering applications of sepn. processes such as this involve diffusional mass transfer that can be treated as a rate process. The chlor-alkali application includes Na⁺, Cl⁻, and OH⁻ plus H₂O as mobile species in NaOH and brine solns. and also between immiscible membrane and soln. phases. These immiscible phases are brought into contact to allow selective transfer of Na⁺ and H₂O from brine to the caustic solns. Previous data on NaOH diffusion through **Nafion** membranes DNaOH are difficult to interpret because not only do they involve OH⁻ and Na⁺ fluxes to give av. diffusion coeffs., but also unknown gradients of electrolyte and H₂O concn. are present in the membrane phase. This work greatly simplifies these problems encountered by isolating and measuring the precise Na⁺ self-diffusion coeff., DNa⁺, with radiotracer techniques in various **Nafion** and **ethylenediamine-modified** membranes. It then relates the DNa⁺ to equiv. wt. surface treatment, and fabric backing in these membranes. These data for DNa⁺ are very important in chlor-alkali cells because the Na⁺ is the major current carrier; therefore, its value can be related to the relative activation energy and voltage drop among similar membranes.

IT 31175-20-9 66796-31-4 73071-55-3

(diffusion in brine-exchanging membrane of, of sodium ion, brine electrolysis in relation to)

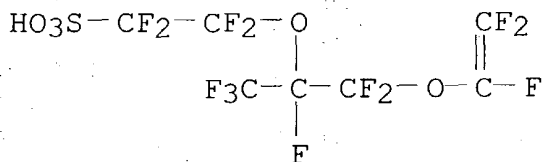
RN 31175-20-9 HCA

CN Ethanesulfonic acid, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 29311-67-9

CMF C7 H F13 O5 S



CM 2

CRN 116-14-3

CMF C2 F4



RN 66796-31-4 HCA

CN Nafion 214 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 73071-55-3 HCA

CN Nafion 295 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 72-10 (Electrochemistry)

Section cross-reference(s): 49, 65, 71

ST sodium diffusion **Nafion** membrane; brine electrolysis

sodium diffusion membrane; radiotracer technique sodium diffusion membrane; brine electrolysis sodium diffusion membrane

IT Brines

(electrolysis of, in diaphragm cell, sodium diffusion in **Nafion** membrane in relation to)

IT Diffusion

(of sodium, in **Nafion** ion-exchanging membranes, radiotracer technique in study of)

IT Electrolytic cells

(diaphragm, for brines, sodium diffusion in **Nafion** ion-exchanger in relation to)

IT Ion exchangers

(membranes, **Nafion**, sodium diffusion in, brine electrolysis in relation to)

IT 31175-20-9 66796-31-4 73071-55-3

(diffusion in brine-exchanging membrane of, of sodium ion, brine electrolysis in relation to)

IT 7440-23-5, properties

(diffusion of, in **Nafion** ion-exchanging membrane, brine electrolysis in relation to)

IT 1310-73-2P, preparation 7782-50-5P, preparation

(manuf. of, in brine electrolysis, sodium diffusion in **Nafion** membrane in relation to)

IT 107-15-3, properties

(sodium diffusion in **Nafion** modified with)

L124 ANSWER 54 OF 56 HCA COPYRIGHT 2004 ACS on STN

91:75471 Cation exchange resin membrane for aqueous alkali chloride

electrolysis. Sata, Toshikatsu; Nakahara, Akihiko; Ito,

Junichi; Shiromizu, Masaki (Tokuyama Soda Co., Ltd., Japan). Jpn.

Kokai Tokkyo Koho JP 54043191 19790405 Showa, 7 pp.

(Japanese). CODEN: JKXXAF. APPLICATION: JP 1977-109410 19770913.

AB Ion exchange resins contained sulfonyl group bonded to a C atom and

to ≥ 1 F and sulfonamide and CO₂H groups at sulfonamide/sulfonamide + CO₂H mol ratio 0.01-0.5. Thus, a C₂F₄-CF₂:CFOCF₂CF(CF₃)O(CF₂)₂SO₂F copolymer membrane was hydrolyzed in the presence of KOH to exchange capacity 0.91 mequiv./g, converted to acid form, treated on one side with PCl₅ at 150° for 1 h, immersed in 29% aq. NH₃ for 5 h and then in 1N HCl for 5 h, washed with 1N HCl, dried at 80° for 1 h and then at 110° for 18 h, and immersed in 10% NaOH (in MeOH) at 41° for 16 h to give a membrane contg. SO₂NH₂ and CO₂H groups in 1:5 ratio on one side to a depth of 20 μ . The membrane had current efficiency (in prodn. of 7.5N NaOH by NaCl electrolysis) 95%, compared with 52% for a control prepd. without the NH₃ treatment.

IT 69087-47-4D, hydrolyzed, carboxylated, amidated
(cation exchange membranes, with high current efficiency in sodium chloride electrolysis)

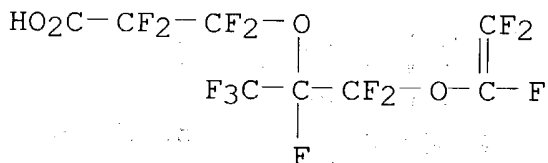
RN 69087-47-4 HCA

CN Propanoic acid, 3-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-2,2,3,3-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 69087-46-3

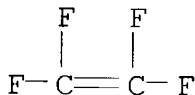
CMF C8 H F13 O4



CM 2

CRN 116-14-3

CMF C2 F4



IC B01J001-08; C08J005-22

CC 37-3 (Plastics Fabrication and Uses)

IT Fluoropolymers

(cation exchange membranes, contg. carboxy- and sulfonamide

groups, for high current efficiency in sodium chloride
electrolysis)

IT Cation exchangers

(membranes, fluoropolymers, contg. carboxy- and sulfonamide
groups, with high current efficiency in sodium chloride
electrolysis)

IT 62-53-3, reactions 107-15-3, reactions 108-18-9 109-73-9,
reactions 109-89-7, reactions 112-57-2 7664-41-7, reactions
(**amidation** by, of fluoropolymers, for cation-exchange
membranes with high current efficiency)

IT 69087-47-4D, hydrolyzed, carboxylated, **amidated**
(cation exchange membranes, with high current efficiency in
sodium chloride **electrolysis)**

L124 ANSWER 55 OF 56 HCA COPYRIGHT 2004 ACS on STN
89:188100 Electrolysis of alkali metal halide. Murayama, Naohiro;
Fukuda, Makoto; Suzuki, Shiro; Sakagami, Teruo (Kureha Chemical
Industry Co., Ltd., Japan). Ger. Offen. DE 2810018 **19780921**
, 26 pp. (German). CODEN: GWXXBX. APPLICATION: DE 1978-2810018
19780306.

AB Cation-exchange membranes with sulfonic acid groups as the
ion-exchange groups are used for electrolysis of brines. These
membranes are caused to react with a primary to tertiary monoamine
or its salt or its quaternary ammonium compd. After that, they are
heated up to a temp. which is $>100^{\circ}$ but is less than the m.p.
of the transformation product, and finally dried. An org.
mono-ammonium salt of the following formula is used for the
transformation of the cation-exchange membrane: $(\text{NRR}_1\text{R}_2\text{R}_3)\text{X}$ where R
is alkyl, aryl or aralkyl or such a halogenated moiety; R₂, R₃ and
R₄ are H, alkyl, or aryl or such a halogenated moiety; and X is F,
Cl, Br, I, OH, NO₃, a carboxylic acid or some other inorg. acid
moiety. Only 1 side of the membrane is treated, the basic material
of which is a fluorocarbon resin. For example, a cation-exchange
membrane of **Nafion** 390, which consists of a fluorocarbon
resin activated by sulfonic acid, was immersed for 17 h in aq. 1M
trimethylaminohydrochloride. Then it was heated for 5 h at
170° in an oven. It was immersed in boiling water for 30 min
and finally used for electrolyzing a 26% aq. NaCl soln. The
electrolysis conditions were: cathode of refined steel, anode of
TiO₂-RuO₂, c.d. 20A/dm² at 76-80°, and with current
efficiency of 93%. This compares with a current efficiency of 75%
for a similar membrane treated only in boiling water for 30 min
before use.

IT 61261-17-4 61261-18-5 61261-19-6
(cation exchange membranes, for brine electrolysis)

RN 61261-17-4 HCA

CN Nafion 110 (9CI) (CA INDEX NAME)

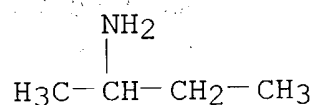
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 61261-18-5 HCA
CN Nafion 315 (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 61261-19-6 HCA
CN Nafion 390 (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 13952-84-6
(in cation exchange membrane treatment, for brine electrolysis)

RN 13952-84-6 HCA
CN 2-Butanamine (9CI) (CA INDEX NAME)



IC C25B013-08
CC 72-10 (Electrochemistry)
Section cross-reference(s): 49

ST electrolysis membrane brine soln; sodium hydroxide manuf brine
membrane; **amine ammonium treatment** membrane
electrolysis

IT 61261-17-4 61261-18-5 61261-19-6
(cation exchange membranes, for brine electrolysis)

IT 56-93-9 75-50-3, uses and miscellaneous 75-57-0 506-59-2
593-81-7 637-39-8 2491-06-7 6309-30-4 12125-02-9, uses and
miscellaneous 13952-84-6 15572-56-2
(in cation exchange membrane treatment, for brine electrolysis)

L124 ANSWER 56 OF 56 HCA COPYRIGHT 2004 ACS on STN
88:192295 Electrolytic diaphragms, and method of electrolysis using the
same. (Tokuyama Soda Co., Ltd., Japan). Brit. GB 1493164
19771123, 34 pp. (English). CODEN: BRXXAA. APPLICATION:
GB 1975-4589 19750203.

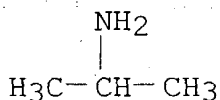
AB Chem.-resistant cation exchange membranes with improved current
efficiencies for the electrolysis of alkali metal salt solns. were
manufd. from a fluoropolymer membrane contg. cation exchange groups
in contact with an elec. neutral layer. E.g., **Nafion**
XR-480 was immersed in 1N HCl, dried 4 h at 80°, and refluxed
with SOCl₂. The base membrane was washed with CCl₄, immersed 24 h
in an 8% EtOH soln. of polyethyleneimine at 40°, immersed in
4.0N NaOH, and immersed 25 h in Ac₂O at 30° to give a cation
exchange membrane with a neutral surface layer contg. sulfonamide,
carboxamide, and sulfonate groups. The membrane was used in the
electrolysis of aq. NaCl at 70° and had a current efficiency
for obtaining NaOH of 96% and an elec. resistance of 4.5 Ω/cm²
compared with 82% and 4.5 Ω/cm², resp., for an untreated
Nafion XR-480 membrane.

IT 75-31-ODP, reaction products with sulfonated fluoropolymers
57407-37-1DP, aminated and fluorinated, polymers with vinyl
compds.

(electrolytic diaphragm, manuf. of)

RN 75-31-0 HCA

CN 2-Propanamine (9CI) (CA INDEX NAME)



RN 57407-37-1 HCA

CN Nafion XR 480 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 57407-36-ODP, aminated, fluorosulfonated, reaction products
with org. acids, and polymers with vinyl compds.

(graft, cation exchange membrane, manuf. of)

RN 57407-36-0 HCA

CN Nafion XR 170 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC C08J007-00

CC 37-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 72

IT 56-81-5DP, reaction products with sulfonated fluoropolymers
75-50-3DP, reaction products with **Nafion** XR-480, polymers
with chloromethylstyrene and glycidyl methacrylate 100-37-8DP,
reaction products with sulfonated fluoropolymers 106-91-2DP,
polymers with aminated and sulfonylated fluoropolymers 108-18-9DP,
reaction products with sulfonated fluoropolymers 108-45-2DP,
reaction products with fluorosulfonylated poly(vinylidene fluoride)
and org. acids 110-18-9DP, reaction products with **Nafion**
XR-480, polymers with chloromethylstyrene and glycidyl methacrylate
110-73-6DP, reaction products with sulfonated fluoropolymers
111-86-4DP, reaction products with sulfonated fluoropolymer
111-87-5DP, reaction products with sulfonated fluoropolymers
115-77-5DP, reaction products with sulfonated fluoropolymers
4067-16-7DP, reaction products with sulfonated fluoropolymer
9002-89-5DP, reaction products with sulfonated fluoropolymers
30030-25-2DP, polymers with aminated and sulfonylated fluoropolymers
63511-67-1DP, reaction products with diisopropylamine and
ethylenediamine 66686-76-8DP, reaction products with alcs. and
polyols

(cation exchange membrane, manuf. of)

IT 62-53-3DP, reaction products with sulfonated fluoropolymers

75-31-ODP, reaction products with sulfonated fluoropolymers

107-15-3DP, reaction products with sulfonated fluoropolymers

112-24-3DP, reaction products with sulfonated fluoropolymers

124-22-1DP, reaction products with sulfonated fluoropolymers
 124-40-3DP, reaction products with sulfonated fluoropolymers
 142-84-7DP, reaction products with sulfonated fluoropolymers
 26913-06-4DP, reaction products with benzoylated and sulfonated
 fluoropolymers 57407-37-1DP, aminated and fluorinated,
 polymers with vinyl compds. 62124-96-3DP, reaction products with
 sulfonated fluoropolymers

(electrolytic diaphragm, manuf. of)

IT 79-11-8DP, reaction products with fluorosulfonated aminated
 fluoropolymers 98-09-9DP, reaction products with fluorosulfonated
 aminated fluoropolymers 98-66-8DP, reaction products with
 fluorosulfonated aminated fluoropolymers 108-24-7DP, reaction
 products with fluorosulfonated aminated fluoropolymers 151-56-4DP,
 polymer with sulfonated fluoropolymers, reaction products with org.
 acids 503-11-7DP, reaction products with fluorosulfonated aminated
 fluoropolymers 24937-79-9DP, reaction products with
 m-phenylenediamine, fluorosulfonated, polymers with org. acids
 25134-67-2DP, benzoylated, nitrated, and sulfonated, polymers with
 polyethyleneimine and vinyl compds. 57407-36-0DP,
 aminated, fluorosulfonated, reaction products with org. acids, and
 polymers with vinyl compds.

(graft, cation exchange membrane, manuf. of)

=> d his 1128-

FILE 'HCA' ENTERED AT 20:51:07 ON 24 JUN 2004

L128 32039 S AMINAT?
 L129 33 S L108 AND L128
 L130 1 S L129 AND (L49 OR L50 OR L51)
 L131 10 S L129 AND (L72 OR L73 OR L74)
 L132 7 S (L130 OR L131) NOT (L120 OR L121)
 L133 7 S L132 AND (1907-2001/PRY OR 1907-2001/PY)

=> d 1133 1-7 cbib abs hitstr hitind

L133 ANSWER 1 OF 7 HCA COPYRIGHT 2004 ACS on STN

136:44489 Galvanodynamic study of the **electrochemical**
 switching effect in perfluorinated cation-exchange membranes
 modified by ethylenediamine. Bessarabov, D. G.; Michaels, W. C.;
 Popkov, Y. M. (Department of Chemistry, University of Stellenbosch,
 Matieland, 7602, S. Afr.). Journal of Membrane Science, 194(1),
 81-90 (English) 2001. CODEN: JMESDO. ISSN: 0376-7388.
 Publisher: Elsevier Science B.V..

AB Perfluorinated sulfonyl-fluoride cation-exchange flat-sheet
 membranes were treated with ethylene diamine to investigate the
 influence of EDA-surface-treatment on the process of

electrochem. "switching" in such membranes. The galvanodynamic method was used to obtain i-V cyclic curves of the membranes. Electroless chem. deposition of Pt particles on modified membranes was achieved using the Takenaka-Torikai method. Galvanodynamic i-V cyclic curves of the plain and platinum-contg. **aminated** membranes were compared. Chem. modification of the membrane surface and membrane structure was investigated by means of elec. cond. measurements and IR-spectroscopy. Exptl. results indicated that the "switching" phenomenon is more likely to occur due to a pH change in the **electrolyte** resulting in the formation of addnl. fixed-charged groups in the **aminated** layers of the membranes rather than due to heterolytic dissocn. of water according to the second Wien effect.

IT 26654-97-7

(cation-exchange membranes modified by ethylenediamine)

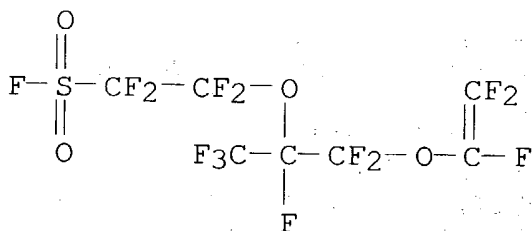
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

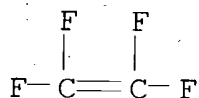
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



CC 72-2 (Electrochemistry)

Section cross-reference(s): 38, 56, 73, 76

ST perfluorinated cation exchange membranes **electrochem**

switching effect

IT Membranes, nonbiological

(bipolar; galvanodynamic study of **electrochem.**

switching effect in perfluorinated cation-exchange membranes
modified by ethylenediamine)

IT Electric switching

(galvanodynamic study of **electrochem.** switching effect
in perfluorinated cation-exchange membranes modified by
ethylenediamine)

IT Cation exchange membranes

(perfluorinated; galvanodynamic study of **electrochem.**
switching effect in perfluorinated cation-exchange membranes
modified by ethylenediamine)

IT 26654-97-7

(cation-exchange membranes modified by ethylenediamine)

IT 107-15-3, Ethylenediamine, uses

(galvanodynamic study of **electrochem.** switching effect
in perfluorinated cation-exchange membranes modified by)

L133 ANSWER 2 OF 7 HCA COPYRIGHT 2004 ACS on STN

135:35193 **Solid polymer electrolyte**

fuel cells and their operation. Terada, Ichiro

(Asahi Glass Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP

2001160408 A2 **20010612**, 6 pp. (Japanese). CODEN: JKXXAF.

APPLICATION: JP 1999-342321 19991201.

AB The fuel gas and/or the oxidn. gas is fed to the electrodes after
their contact with ion exchangers. Operation of the cells including
the above stated process is also claimed.

IT 26654-97-7P

(cation exchange filter; operation of **solid**
polymer electrolyte fuel

cells by treatment of fuel gas and/or oxidn. gas through
ion exchangers before their feeding to electrodes)

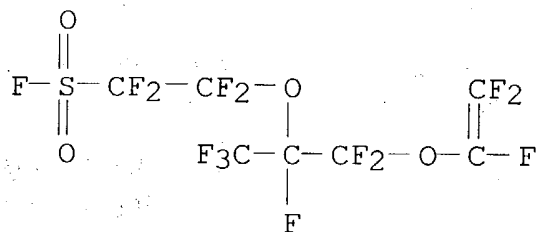
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl
]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with
tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

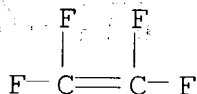
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



IC ICM H01M008-10

ICS H01M008-02; H01M008-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 38ST **solid polymer electrolyte fuel****cell** operation; gas ion exchange treatment **fuel****cell**; oxidn gas ion exchange treatment **fuel****cell**; polysulfone polythioether ion exchanger **fuel****cell**

IT Polyolefin fibers

(ethylene, ion exchanger support; operation of **solid polymer electrolyte fuel****cells** by treatment of fuel gas and/or oxidn. gas through ion exchangers before their feeding to electrodes)

IT Polyolefin fibers

Synthetic polymeric fibers, uses

(ethylene-styrene, graft, chlorosulfonated, chloromethylated, and quaternized, anion exchange filter; operation of **solid polymer electrolyte fuel****cells** by treatment of fuel gas and/or oxidn. gas through ion exchangers before their feeding to electrodes)

IT Alkenes, uses

(fluoro, ion exchanger layer formed on; operation of **solid polymer electrolyte****fuel cells** by treatment of fuel gas and/or oxidn. gas through ion exchangers before their feeding to electrodes)

- IT Polyolefins
(ion exchanger layer formed on; operation of **solid polymer electrolyte fuel cells** by treatment of fuel gas and/or oxidn. gas through ion exchangers before their feeding to electrodes)
- IT Anion exchangers
Cation exchangers
Ion exchange
Solid state **fuel cells**
(operation of **solid polymer electrolyte fuel cells** by treatment of fuel gas and/or oxidn. gas through ion exchangers before their feeding to electrodes)
- IT Polythioethers
(polysulfone-, chloromethylated and **aminated**, anion exchange filters; operation of **solid polymer electrolyte fuel cells** by treatment of fuel gas and/or oxidn. gas through ion exchangers before their feeding to electrodes)
- IT Polysulfones, uses
(polythioether-, chloromethylated and **aminated**, anion exchange filters; operation of **solid polymer electrolyte fuel cells** by treatment of fuel gas and/or oxidn. gas through ion exchangers before their feeding to electrodes)
- IT 75-50-3DP, Trimethylamine, reaction products with chloromethylated polymers 25608-64-4DP, chloromethylated, reaction products with trimethylamine
(anion exchange filter; operation of **solid polymer electrolyte fuel cells** by treatment of fuel gas and/or oxidn. gas through ion exchangers before their feeding to electrodes)
- IT 26654-97-7P
(cation exchange filter; operation of **solid polymer electrolyte fuel cells** by treatment of fuel gas and/or oxidn. gas through ion exchangers before their feeding to electrodes)
- IT 106826-12-4DP, Ethylene-styrene graft copolymer, chlorosulfonated, chloromethylated, reaction products with trimethylamine, quaternized (fiber, anion exchange filter; operation of **solid polymer electrolyte fuel cells** by treatment of fuel gas and/or oxidn. gas through ion exchangers before their feeding to electrodes)
- IT 9002-88-4, Polyethylene
(ion exchanger support; operation of **solid polymer electrolyte fuel cells** by treatment of fuel gas and/or oxidn. gas through ion exchangers before their feeding to electrodes)

L133 ANSWER 3 OF 7 HCA COPYRIGHT 2004 ACS on STN

93:227602 Cation exchange membrane for **electrolysis** cells.

(Toyo Soda Mfg. Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP
55089493 19800707 Showa, 9 pp. (Japanese). CODEN:
JKXXAF. APPLICATION: JP 1978-160150 19781227.

AB A cation exchange membrane for use in **electrolysis** cells
is obtained by impregnating a fluorocarbon polymer contg. SO₃H group
and ≥1 cation-exchangeable group(s) of lower acid strength
than SO₃H (no. of cation exchangeable moieties unequal between the 2
surfaces) with a diene deriv., contg. a COOH group or group(s)
convertible to a COOH group, partially polymg. the diene deriv.,
soaking in a water-miscible solvent (b.p. ≥30° at 760
torr), pressing the membrane between 2 smooth plates, and heating at
250-180°, or when groups convertible to COOH are present
converting them to COOH.

IT 26654-97-7D, **aminated**, hydrolyzed, impregnated
with butadienecarboxylic acid
(membrane from)

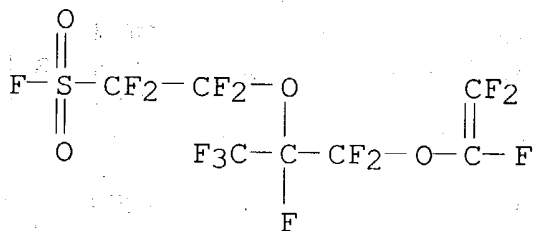
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl
]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with
tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

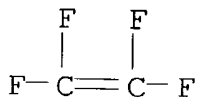
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4

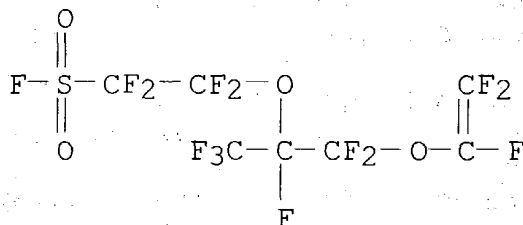


- IC C25B013-08; C08J005-22
CC 72-10 (Electrochemistry)
Section cross-reference(s): 37, 66
ST fluoropolymer diene impregnated cation exchanger;
electrolysis cation exchanger membrane fluoropolymer;
butadiene carboxylic acid impregnation fluoropolymer
IT **Electrolytic** cells
(membranes for, diene-impregnated fluoropolymer
cation-exchanging)
IT Fluoropolymers
(sulfonic acid group-contg., membranes, butadienecarboxylic
acid-mpregnated, for **electrolysis**)
IT 626-99-3
(impregnation with, of fluoropolymers, for membranes for
electrolysis)
IT 26654-97-7D, **aminated**, hydrolyzed, impregnated
with butadienecarboxylic acid
(membrane from)
- L133 ANSWER 4 OF 7 HCA. COPYRIGHT 2004 ACS on STN
91:194373 Heat-treated fluorocarbon sulfonamide cation exchange
membrane. Burkhardt, Samuel F.; Maloney, Daniel E. (Diamond
Shamrock Corp., USA; du Pont de Nemours, E. I., and Co.). U.S. US
4168216 **19790918**, 11 pp. (English). CODEN: USXXAM.
APPLICATION: US 1978-946172 19780927.
- AB Ion exchange membranes useful in chloralkali **electrolysis**
cells with high current efficiency over extended time periods
consist of fluorinated polymers contg. sulfonamide groups which are
heat-treated ≥ 15 min at 100-60°. Thus,
perfluoro-3,6-dioxa-4-methyl-7-octenesulfonyl fluoride-
tetrafluoroethylene copolymer membrane was hydrolyzed with strong
base and treated on 1 surface with an ethylenediamine soln. and
reinforced with Teflon fabric. The membrane was heat-treated in a
vacuum oven 24 h at 110°. The membrane had a current
efficiency 87% while yielding 29% NaOH in a NaCl
electrolysis cell over 23 days. When the membrane was not
heat-treated, the current efficiency was 83%, and NaOH concn. was
27% after 28 days.
- IT 26654-97-7D, **aminated**
(ion exchanging membranes, heat-treated, for chloralkali
electrolysis cells with improved efficiency and extended
life)
- RN 26654-97-7 HCA
CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl
]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with
tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

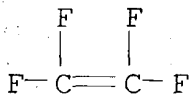
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



IC C25B001-20; C25B001-26; C25B013-08

NCL 204098000

CC 37-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 72

ST sulfonamide ion exchanger **electrolysis**; fluoropolymer membrane brine **electrolysis**; chloralkali ion exchanging membrane; sodium hydroxide manuf membrane

IT Brines

(**electrolysis** of, heat-treated ion-exchanging membranes for, with increased efficiency and extended life)

IT Ion exchangers

(membranes, heat-treated **aminated** perfluorodioxaoctenesulfonylfluoride-tetrafluoroethylene copolymers as, for **electrolysis** of brine)

IT 26654-97-7D, **aminated**

(ion exchanging membranes, heat-treated, for chloralkali **electrolysis** cells with improved efficiency and extended life)

IT 1310-73-2P, preparation

(manuf. of, by brine **electrolysis**, heat-treated ion-exchanging membranes for)

90:122497 Fluorocarbon cation-exchange membrane. Hamada, Masato; Seko, Masaomi; Yamagoshi, Yasumichi; Miyauchi, Hirotsugu; Kimoto, Yasushi (Asahi Chemical Industry Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 53141188 **19781208** Showa, 6 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1977-55955 19770517.

AB Fluorocarbon membranes contg. $\text{CF}_2\text{CF}_2\text{SO}_2\text{NR}_1\text{R}_2$ (I, $\text{R}_1, \text{R}_2 = \text{H, Na, K,}$ or C1-6 alkyl) and/or $\text{CF}_2\text{CF}_2\text{SO}_2\text{NR}_3(\text{CH}_2)_n\text{R}_3\text{R}_4$ (II, $n = 2-6; \text{R}_3 = \text{H, Na,}$ or K; $\text{R}_4 = \text{R}_3$ or SO_2) in the backbone or as side chains are treated with aq. HNO_2 , a nitrite, or an alkyl nitrite. Copolymer membranes prepd. from C_2F_4 and a fluorocarbon vinyl ether contg. SO_2F are treated with NH_3 to form I ($\text{R}_1, \text{R}_2 = \text{H}$), with ethylenediamine to form II ($\text{R}_3 = \text{H, R}_4 = \text{H or SO}_2$), with BuNH_2 to form I ($\text{R}_1 = \text{H, R}_2 = \text{Bu}$), or with their mixts. to form I and II to ≥ 10 nm depth on 1 or both sides. I and/or II groups are converted to COOH to give a membrane esp. suitable for **electrolysis** of aq. NaCl . Thus, polymg. C_2F_4 and perfluoro(3,6-dioxa-4-methyl-7-octenesulfonyl fluoride) in the presence of $(\text{NH}_4)_2\text{S}_2\text{O}_8$ and NH_4 perfluorooctanoate at 70° and at 4 atm C_2F_4 , washing, sapong. to obtain an exchange capacity 0.92 mequiv/g dry basis, hot-forming to a 0.3-mm thick film, sealing on 1 side with a Teflon adhesive tape, soaking in liq. NH_3 at -50° for 16 h, sepg., vacuum-drying, soaking in aq. HNO_2 at 60° for 10 h, and sapong. in 2N NaOH in 50% MeOH gave the title membrane. The 5 + 3 cm membrane contg. COOH to a 100 μ depth was placed against a cathode, and 3N NaCl at pH 3 and 30% NaOH were circulated through the anode and cathode chambers, resp. Current efficiency during **electrolysis** at 90° and c.d. 50 A/Dm² was 91%, as compared with 58 for a membrane contg. no COOH .

IT **26654-97-7D, aminated, nitrited, sapond.**

(cation exchanger membranes, for **electrolysis** of sodium chloride)

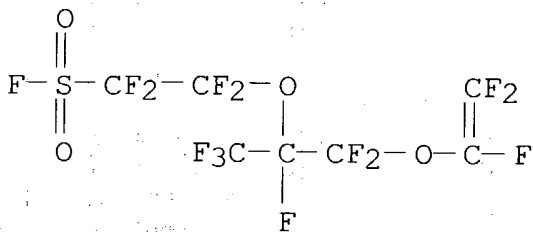
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

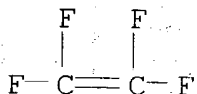
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



- IC C08J005-22
 CC 36-3 (Plastics Manufacture and Processing)
 ST cation exchanger fluoropolymer membrane; **electrolysis**
 sodium chloride fluoropolymer membrane; carboxy contg fluoropolymer
 membrane
 IT Fluoropolymers
 (cation exchanger membranes, carboxy-contg., for
electrolysis of sodium chloride)
 IT **Electrolysis**
 (of aq. sodium chloride, cation exchanger membrane for,
 carboxy-contg. fluoropolymers as)
 IT Cation exchangers
 (membranes, carboxy-contg. fluoropolymers, for
electrolysis of sodium chloride)
 IT 26654-97-7D, aminated, nitrited, saponified.
 (cation exchanger membranes, for **electrolysis** of sodium
 chloride)
 IT 7647-14-5, reactions
 (**electrolysis** of, cation exchanger membranes for,
 carboxy-contg. fluoropolymers as)

L133 ANSWER 6 OF 7 HCA COPYRIGHT 2004 ACS on STN

89:50607 Ion exchange polymer film, consisting of fluorinated polymer
 with N-monosubstituted sulfonamido groups method and apparatus for
electrolysis of alkali or alkaline earth metal halide.

Resnick, Paul Raphael; Grot, Walther Gustav (du Pont de Nemours, E.
 I., and Co., USA). U.S. US 4085071 19780418, 9 pp.

(English). CODEN: USXXAM. APPLICATION: US 1975-623920 19751020.

AB This polymer material is useful as a separator in a cell for the prodn. of concd. NaOH by the **electrolysis** of brine. A copolymer of F₂C:CF₂ and CF₂:CFOCF₂CF(CF₃)OCF₂ CF₂SO₂F was made. The equiv. wt. is 1146 indicating a mol. ratio of 7:1. This polymer was mixed with a 40% aq. soln. of MeNH₂, stirred at room temp. for 16 h, and washed with H₂O. IR spectra by attenuated total reflectance indicated the conversion of the sulfonyl fluoride groups to -SO₃- and -SO₂NHCH₃. It is desirable to use the film in the 0.002-0.02 in. thickness range; excessive film thickness increases the elec. resistance.

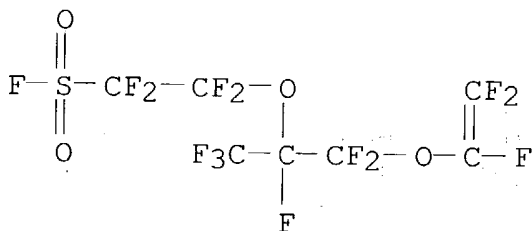
IT **26654-97-7D, aminated**
(separator, for brine **electrolysis**)

RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

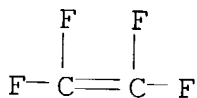
CM 1

CRN 16090-14-5
CMF C7 F14 O4 S



CM 2

CRN 116-14-3
CMF C2 F4



IC C09D003-78
NCL 260022000R
CC 72-10 (Electrochemistry)
Section cross-reference(s): 49
ST **electrolytic cell separator brine electrolysis;**

- fluoro polymer brine **electrolysis** separator; sodium hydroxide chlorine electroprodn brine
- IT Brines
(**electrolysis** of, fluoro polymer separator for)
- IT **Electrolytic** cells
(for brine **electrolysis**, fluoro polymer separator for)
- IT 26654-97-7D, aminated
(separator, for brine **electrolysis**)
- L133 ANSWER 7 OF 7 HCA COPYRIGHT 2004 ACS on STN
- 83:80327 N-Monosubstituted sulfonamido groups-containing, fluorine-containing ion exchanging polymers. Resnick, Paul R.; Grot, Walther G. (du Pont de Nemours, E. I., and Co., USA). Ger. Offen. DE 2437395 19750417, 28 pp. (German). CODEN: GWXXBX. APPLICATION: DE 1974-2437395 19740802.
- AB A copolymer (I) [26654-97-7] of CF₂:CF₂ and CF₂:CFOCF₂CF(CF₃)OCF₂CF₂SO₂F was treated, as a film, with 1,2-ethanediamine (II) [107-15-3], MeNH₂ [74-89-5], or another amine to give substituted sulfonamido groups on the film surfaces. The films were useful in **electrolysis** cells used for Cl₂ manuf. Thus, a 0.127 mm film of I was treated on one side with II for 15 min to give a film contg. substituted sulfonamido groups to a depth of 0.0178 mm. The remaining sulfonyl fluoride groups were converted to SO₃K groups during 6 hr at 60° in water contg. KOH and Me₂SO. The film was used in an **electrolysis** cell to manuf. Cl₂, giving a current yield of 91% with cell voltage 3.6 volts.
- IC C08L
- CC 36-4 (Plastics Manufacture and Processing)
Section cross-reference(s): 49
- ST fluoropolymer sulfonamido ion exchanger; membrane fluoropolymer sulfonamido; **electrolysis** cell fluoropolymer membrane; chlorine manuf **electrolysis** membrane; **amination** sulfonyl fluoropolymer
- IT **Electrolytic** cells
(for chlorine, ion exchange membranes for)
- IT Ion exchangers
(membranes, sulfonamido-contg. fluoropolymers as, for **electrolytic** cells)
- IT 1,2-Ethanediamine, reaction products with fluorosulfonyl-contg. fluoropolymers
1,2-Ethanediamine, N,N'-bis(2-aminoethyl)-, reaction products with fluorosulfonyl-contg. fluoropolymers
1,6-Hexanediamine, reaction products with fluorosulfonyl-contg. fluoropolymers
Benzenamine, reaction products with fluorosulfonyl-contg. fluoropolymers
Cyclohexanamine, reaction products with fluorosulfonyl-contg.

fluoropolymers

Ethanamine, reaction products with fluorosulfonyl-contg.

fluoropolymers

Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene, reaction products with amines

Ethene, tetrafluoro-, polymer with 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoroethanesulfonyl fluoride, reaction products with amines

Hydrazine, reaction products with fluorosulfonyl-contg.

fluoropolymers

Methanamine, reaction products with fluorosulfonyl-contg.

fluoropolymers

(ion exchange membranes, for **electrolysis** cells).

=> d 1121 1-22 cbib abs hitstr hitind

L121 ANSWER 1 OF 22 HCA COPYRIGHT 2004 ACS on STN

140:409629 Method of fabrication of lithium polymer energy storage systems. Naarmann, Herbert; Kruger, Franz Josef (Gaia Akkumulatorenwerke G.m.b.H., Germany). Ger. Offen. DE 10251238 A1 20040519, 14 pp. (German). CODEN: GWXXBX. APPLICATION: DE 2002-10251238 20021104.

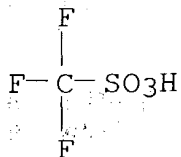
AB A new procedure for the prodn. of a lithium polymer energy storage system is disclosed. The energy storage systems so produced have an active cathode mass, a polymer **electrolyte** separator and an active anode mass. The active electrode masses are mixed with conducting salts and optionally conducting salt additives and/or solvents, ground intensively, the active electrode masses subsequently formed with polymer binders to batches, extruded and laminated on a current collector. The laminated electrode masses are laminated sep. optionally with laminated separator in sandwich layer and are joined together, so that the active electrode masses have porous structure. The present invention creates a targeted and orderly arrangement and allocation of the active electrode components with optimized effectiveness, as compared to the conventional procedures where the resp. components of the electrode masses are present randomly distributed only according to the coincidence principle.

IT 33454-82-9, Lithium triflate 90076-65-6, Lithium bis(trifluoromethylsulfonyl) imide

(method of fabrication of lithium polymer energy storage systems)

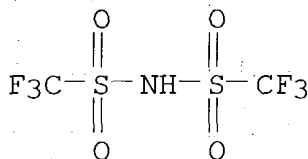
RN 33454-82-9 HCA

CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



● Li

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-,
lithium salt (9CI) (CA INDEX NAME)

● Li

IT 25190-89-0, Hexafluoropropylene-tetrafluoroethylene-
vinylidene fluoride copolymer

(method of fabrication of lithium polymer energy storage systems)

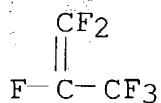
RN 25190-89-0 HCA

CN 1-Propene, 1,1,2,3,3,3-hexafluoro-, polymer with 1,1-difluoroethene
and tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 116-15-4

CMF C3 F6



CM 2

CRN 116-14-3

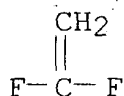
CMF C2 F4



CM 3

CRN 75-38-7

CMF C2 H2 F2



- IC ICM H01M004-04
ICS H01M004-48; H01M010-04; H01M010-40
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 38, 76
- IT 7429-90-5, Aluminum, uses 7439-93-2D, Lithium, org. borate
7440-50-8, Copper, uses 7782-42-5, Graphite, uses 7791-03-9,
Lithium perchlorate 9033-83-4, Polyphenylene 11126-15-1, Lithium
vanadium oxide 12627-14-4, Lithium silicate 13453-69-5, Lithium
metaborate 14283-07-9, Lithium tetrafluoroborate 18115-70-3,
Lithium acetylacetonate, uses 21324-40-3, Lithium
hexafluorophosphate 25067-58-7, Polyacetylene 33454-82-9
, Lithium triflate 37296-91-6, Lithium molybdenum oxide
37349-20-5, Lithium tungsten oxide 39300-70-4, Lithium nickel
oxide 39302-37-9, Lithium titanium oxide 39457-42-6, Lithium
manganese oxide 51177-06-1, Chromium lithium oxide 51222-70-9,
Lithium zirconium oxide 52627-24-4, Cobalt Lithium oxide
90076-65-6, Lithium bis(trifluoromethylsulfonyl)
imide
(method of fabrication of lithium polymer energy storage systems)
- IT 57-13-6, Urea, uses 79-41-4D, Methacrylic acid, fluoroalkyl ester
463-79-6D, Carbonic acid, alkyl ester 1304-28-5, Barium oxide
(BaO), uses 1309-48-4, Magnesium oxide (MgO), uses 1344-28-1,
Alumina, uses 7631-86-9, Silica, uses 9002-88-4, Polyethylene
9003-19-4, Polyvinyl ether 9003-29-6, Polybutene 9003-53-6,
Polystyrene 24968-97-6, Polypyrrolidone 25038-32-8,
Isoprene-styrene copolymer 25190-89-0,
Hexafluoropropylene-tetrafluoroethylene-vinylidene fluoride
copolymer 26602-62-0, Butadiene-Isoprene-styrene copolymer
(method of fabrication of lithium polymer energy storage systems)

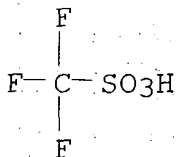
140:393386 Procedure for fabrication of lithium-polymer energy storage systems. Naarmann, Herbert; Kruger, Franz Josef (Gaia Akkumulatorenwerke G.m.b.H., Germany). Ger. Offen. DE 10251194 A1 20040519, 13 pp. (German). CODEN: GWXXBX. APPLICATION: DE 2002-10251194 20021104.

AB A lithium-polymer energy storage system comprises an active cathode mass, a polymer **electrolyte**-separator, and an active anode mass. The active electrode masses are mixed and ground with conducting salts (if necessary with conducting salt additives) and solvents in a first process stage; in a second process stage it is intimately mixed with a polymer binder; and then in a third process stage are extruded and laminated sep. on a current collector; and the laminated electrode masses are joined together optionally with laminated separator in sandwich layer, so that the active electrode masses have defined structures. Esp., the procedure creates a targeted and orderly arrangement and allocation of the active electrode components with optimized effectiveness by the three successively arranged process stages.

IT 33454-82-9, Lithium triflate 90076-65-6, Lithium bis(trifluoromethylsulfonyl)imide
(procedure for fabrication of lithium-polymer energy storage systems)

RN 33454-82-9 HCA

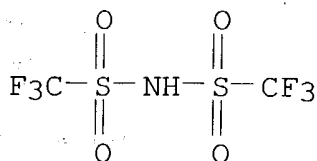
CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



● Li

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

IT 25190-89-0, Hexafluoropropene-tetrafluoroethene-vinylidene
fluoride copolymer
(procedure for fabrication of lithium-polymer energy storage
systems)

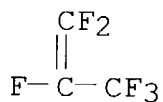
RN 25190-89-0 HCA

CN 1-Propene, 1,1,2,3,3,3-hexafluoro-, polymer with 1,1-difluoroethene
and tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 116-15-4

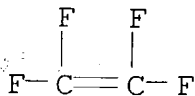
CMF C3 F6



CM 2

CRN 116-14-3

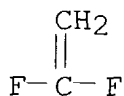
CMF C2 F4



CM 3

CRN 75-38-7

CMF C2 H2 F2



- IC ICM H01M004-04
ICS H01M004-48; H01M004-62; H01M002-14
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 38
- IT 7439-93-2D, Lithium, organoborate 7782-42-5, Graphite, uses
7791-03-9, Lithium perchlorate 9033-83-4, Polyphenylene
11126-15-1, Lithium vanadium oxide 14283-07-9, Lithium
tetrafluoroborate 21324-40-3, Lithium hexafluorophosphate
25067-58-7, Polyacetylene **33454-82-9**, Lithium triflate
37296-91-6, Lithium molybdenum oxide 37349-20-5, Lithium tungsten
oxide 39300-70-4, Lithium nickel oxide 39302-37-9, Lithium
titanium oxide 39457-42-6, Lithium manganese oxide 51177-06-1,
Chromium lithium oxide 51222-70-9, Lithium zirconium oxide
52627-24-4, Cobalt lithium oxide **90076-65-6**, Lithium bis(
trifluoromethylsulfonyl)imide
(procedure for fabrication of lithium-polymer energy storage
systems)
- IT 79-41-4D, Methacrylic acid, fluoroalkyl ester 463-79-6D, Carbonic
acid, alkyl ester 1304-28-5, Barium oxide (BaO), uses 1309-48-4,
Magnesium oxide (MgO), uses 1344-28-1, Alumina, uses 7631-86-9,
Silica, uses 9002-88-4, Polyethylene 9003-19-4, Polyvinyl ether
9003-29-6, Polybutene 9003-53-6, Polystyrene 12627-14-4, Lithium
silicate 13453-69-5, Lithium metaborate 18115-70-3, Lithium
acetylacetonate, uses 24968-97-6, Polypyrrolidone
25190-89-0, Hexafluoropropene-tetrafluoroethene-vinylidene
fluoride copolymer
(procedure for fabrication of lithium-polymer energy storage
systems)

L121 ANSWER 3 OF 22 HCA COPYRIGHT 2004 ACS on STN

140:79836 **Electrolyte** of lithium-sulfur batteries. Kim, Seok;
Jung, Yongju; Kim, Jan-Dee (Samsung SDI Co., Ltd, S. Korea). U.S.
Pat. Appl. Publ. US 2004009393 A1 20040115, 15 pp. (English).
CODEN: USXXCO. APPLICATION: US 2003-617230 20030711. PRIORITY: KR
2002-40707 20020712.

AB An **electrolyte** for use in a lithium-sulfur battery
includes salts having imide anions. The **electrolyte** may
further include salts having org. cations. When lithium-sulfur
batteries include salts having imide anions as **electrolytes**
, the sulfur utilization is increased, and cycle life
characteristics and discharge characteristics such as discharge
capacity and av. discharge voltage are improved.

IT 9002-84-0, Ptfе
 (binder; **electrolyte** of lithium-sulfur batteries)
 RN 9002-84-0 HCA
 CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

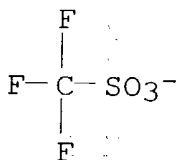
CM 1

CRN 116-14-3

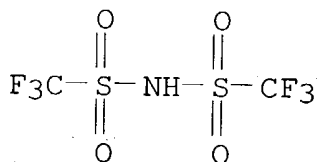
CMF C2 F4



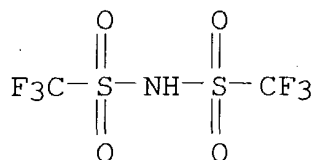
IT 37181-39-8, Trifluoromethylsulfonate 82113-65-3,
 Bis(trifluoromethylsulfonyl)imide
 90076-65-6 132273-39-3 132843-44-8
 (**electrolyte** of lithium-sulfur batteries)
 RN 37181-39-8 HCA
 CN Methanesulfonic acid, trifluoro-, ion(1-) (9CI) (CA INDEX NAME)



RN 82113-65-3 HCA
 CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-
 (9CI) (CA INDEX NAME)



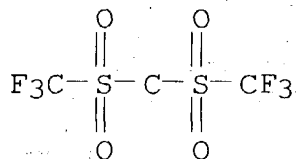
RN 90076-65-6 HCA
 CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-,
 lithium salt (9CI) (CA INDEX NAME)



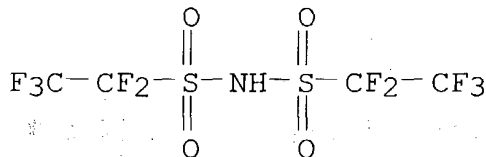
● Li

RN 132273-39-3 HCA

CN Methylene, bis[(trifluoromethyl)sulfonyl]- (9CI) (CA INDEX NAME)



RN 132843-44-8 HCA

CN Ethanesulfonamide, 1,1,2,2,2-pentafluoro-N-
[(pentafluoroethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)

● Li

IC ICM H01M010-40

ICS H01M004-58

NCL 429188000; 429330000; 429218100; 429340000; 429341000

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **electrolyte** lithium sulfur battery

IT Polyoxyalkylenes, uses

(alkylated, binder; **electrolyte** of lithium-sulfur
batteries)

IT Fluoropolymers, uses

Polyoxyalkylenes, uses

(binder; **electrolyte** of lithium-sulfur batteries)

- IT Polyoxyalkylenes, uses
(crosslinked, binder; **electrolyte** of lithium-sulfur batteries)
- IT Ethers, uses
(cyclic, bicyclic; **electrolyte** of lithium-sulfur batteries)
- IT Battery **electrolytes**
(**electrolyte** of lithium-sulfur batteries)
- IT Aromatic compounds
 - Esters, uses
 - Heterocyclic compounds
 - Imides
 - Ketones, uses
 - Lactones
 - Sulfates, uses
 - Sulfites
 - Sulfoxides
 - (**electrolyte** of lithium-sulfur batteries)
- IT Group IIIA elements
(**electrolyte** of lithium-sulfur batteries)
- IT Group IVA elements
(**electrolyte** of lithium-sulfur batteries)
- IT Transition metals, uses
(**electrolyte** of lithium-sulfur batteries)
- IT Secondary batteries
(lithium; **electrolyte** of lithium-sulfur batteries)
- IT Heterocyclic compounds
(nitrogen, Li protecting compd.; **electrolyte** of lithium-sulfur batteries)
- IT Heterocyclic compounds
(oxygen, Li protecting compd.; **electrolyte** of lithium-sulfur batteries)
- IT Ethers, uses
(satd., Li protecting compd.; **electrolyte** of lithium-sulfur batteries)
- IT Heterocyclic compounds
(sulfur, Li protecting compd.; **electrolyte** of lithium-sulfur batteries)
- IT Ethers, uses
(unsatd., Li protecting compd.; **electrolyte** of lithium-sulfur batteries)
- IT lithium alloy, base
(**electrolyte** of lithium-sulfur batteries)
- IT 9002-84-0, Ptfе 9002-86-2, Polyvinyl chloride 9002-89-5,
Polyvinyl alcohol 9003-19-4, Polyvinyl ether 9003-20-7,
Polyvinyl acetate 9003-32-1, Polyethyl acrylate 9003-39-8,
Polyvinyl pyrrolidone 9003-47-8, Polyvinylpyridine 9003-53-6,
Polystyrene 9011-14-7, Pmma 9011-17-0, Hexafluoropropylene-

vinylidene fluoride copolymer 24937-79-9, Polyvinylidene fluoride 25014-41-9, Polyacrylonitrile 25322-68-3, Peo 25322-68-3D, Peo, alkylated 25322-68-3D, Peo, crosslinked

(binder; **electrolyte** of lithium-sulfur batteries)

IT 110-71-4 463-79-6D, Carbonic acid, acyclic compd. 463-79-6D, Carbonic acid, bicyclic salt 646-06-0, Dioxolane 7439-93-2, Lithium, uses 14797-73-0, Perchlorate 14874-70-5, Tetrafluoroborate 16919-18-9, Hexafluorophosphate 16969-45-2D, Pyridinium, compd. 16973-45-8, Hexafluoroarsenate 17009-90-4D, Imidazolium, compd. 17009-91-5D, Pyrazolium, compd. 17009-93-7D, Pyrazinium, compd. 17009-95-9D, Pyrimidinium, compd. 17009-97-1D, Pyridazinium, compd. 28589-79-9D, Thiazolium, compd. 37181-39-8, Trifluoromethylsulfonate 64001-57-6D, Oxazolium, compd. 65039-03-4D, 1-Ethyl-3-methylimidazolium, compd. 74432-42-1, Lithium polysulfide 80432-08-2, 1-Butyl-3-methylimidazolium 82113-65-3, Bis(trifluoromethylsulfonyl)imide 90076-65-6 129318-46-3, Bis(perfluoroethylsulfonyl)imide 132273-39-3 132843-44-8 157310-70-8D, 1H-Imidazolium, 1,2-dimethyl-3-propyl-, compd. 174501-64-5, 1-Butyl-3-methylimidazolium hexafluorophosphate 216299-76-2

(**electrolyte** of lithium-sulfur batteries)

IT 7429-90-5, Aluminum, uses 7439-88-5, Iridium, uses 7439-89-6, Iron, uses 7439-92-1, Lead, uses 7439-96-5, Manganese, uses 7439-97-6, Mercury, uses 7439-98-7, Molybdenum, uses 7440-02-0, Nickel, uses 7440-03-1, Niobium, uses 7440-04-2, Osmium, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-15-5, Rhenium, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses 7440-20-2, Scandium, uses 7440-21-3, Silicon, uses 7440-22-4, Silver, uses 7440-25-7, Tantalum, uses 7440-26-8, Technetium, uses 7440-28-0, Thallium, uses 7440-31-5, Tin, uses 7440-32-6, Titanium, uses 7440-33-7, Tungsten, uses 7440-43-9, Cadmium, uses 7440-47-3, Chromium, uses 7440-48-4, Cobalt, uses 7440-50-8, Copper, uses 7440-55-3, Gallium, uses 7440-56-4, Germanium, uses 7440-57-5, Gold, uses 7440-62-2, Vanadium, uses 7440-65-5, Yttrium, uses 7440-66-6, Zinc, uses 7440-67-7, Zirconium, uses 7440-74-6, Indium, uses

(**electrolyte** of lithium-sulfur batteries)

L121 ANSWER 4 OF 22 HCA COPYRIGHT 2004 ACS on STN

138:341123 Cathode, its use in solid **electrolyte** battery, and its manufacture. Sasaki, Yoshinari; Kiyoi, Kiyomi; Murase, Hidetoshi; Shimotoku, Hiroshi; Aso, Yukinari (Sony Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2003132877 A2 20030509, 13 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-325579 20011023.

AB The cathode has ion-conducting polymers, binders, **electrolyte** salts, cathode active mass particles, and conducting aids dispersed to form a cathode active mass layer on a

collector. The cathode is manufd. by (1) dissolving binders in a solvent to prep. a primary soln., (2) dispersing conducting aids and cathode active mass particles in the soln. to prep. a secondary soln., (3) dissolving ion-conducting polymers and **electrolyte** salts in a secondary solvent to prep. a tertiary soln., (4) mixing the secondary soln. and the tertiary soln., (5) adjusting viscosity of the resulting soln., (6) applying the viscosity-adjusted soln. on a collector and removing solvents to form an active mass precursor, and (7) pressing the collector and the precursor. The battery using the cathode has high ion cond., electron cond., and capacity.

IT 9002-84-0, Polytetrafluoroethylene
(binder in cathode; cathode having high ion cond. and electron cond. and capacity and its manuf. for solid **electrolyte** battery)

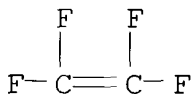
RN 9002-84-0 HCA

CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

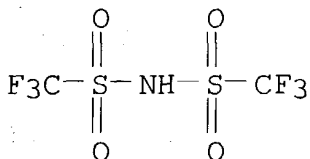
CMF C2 F4



IT 90076-65-6, Lithium bistrifluoromethylsulfonylimide
(**electrolyte** in cathode; cathode having high ion cond. and electron cond. and capacity and its manuf. for solid **electrolyte** battery)

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

IC ICM H01M004-02

ICS H01M004-04; H01M004-06; H01M004-08; H01M004-62; H01M006-18;
H01M010-40

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 38

ST ion conducting **polymer** cathode **solid**
electrolyte battery

IT Fluoropolymers, uses
Styrene-butadiene rubber, uses
(binder in cathode; cathode having high ion cond. and electron
cond. and capacity and its manuf. for solid **electrolyte**
battery)

IT Battery cathodes
Polymer **electrolytes**
(cathode having high ion cond. and electron cond. and capacity
and its manuf. for solid **electrolyte** battery)

IT Polyoxyalkylenes, uses
Polysiloxanes, uses
(ion-conducting polymer in cathode; cathode having high ion cond.
and electron cond. and capacity and its manuf. for solid
electrolyte battery)

IT 9002-84-0, Polytetrafluoroethylene 24937-79-9,
Poly(vinylidene fluoride)
(binder in cathode; cathode having high ion cond. and electron
cond. and capacity and its manuf. for solid **electrolyte**
battery)

IT 12190-79-3, Lithium cobalt oxide (LiCoO_2)
(cathode active mass; cathode having high ion cond. and electron
cond. and capacity and its manuf. for solid **electrolyte**
battery)

IT 7429-90-5, Aluminum, uses
(cathode collector; cathode having high ion cond. and electron
cond. and capacity and its manuf. for solid **electrolyte**
battery)

IT 7782-42-5, Graphite, uses
(conducting aid in cathode; cathode having high ion cond. and
electron cond. and capacity and its manuf. for solid
electrolyte battery)

IT 90076-65-6, Lithium bistrifluoromethylsulfonylimide
(**electrolyte** in cathode; cathode having high ion cond.
and electron cond. and capacity and its manuf. for solid
electrolyte battery)

IT 25322-68-3, Poly(ethylene oxide) 115401-75-7, Ethylene
oxide-2-(2-methoxyethoxyethyl)glycidyl ether copolymer
(ion-conducting polymer in cathode; cathode having high ion cond.
and electron cond. and capacity and its manuf. for solid
electrolyte battery)

IT 9003-55-8
(styrene-butadiene rubber, binder in cathode; cathode having high

ion cond. and electron cond. and capacity and its manuf. for solid **electrolyte** battery)

L121 ANSWER 5 OF 22 HCA COPYRIGHT 2004 ACS on STN

138:30831 Flexible electrochromic structure and methods for the production thereof. Hourquebie, Patrick; Topart, Patrice; Pages, Hubert (Commissariat a l'Energie Atomique, Fr.). PCT Int. Appl. WO 2002097519 A2 20021205, 34 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (French). CODEN: PIXXD2. APPLICATION: WO 2002-FR1807 20020529. PRIORITY: FR 2001-7144 20010531.

AB The invention relates to a flexible electrochromic structure which operates as a reflector at wavelengths ranging from (0,35) to (20) μm . The inventive structure comprises a microporous membrane including an **electrolyte** and the following items successively disposed in the following order on each of the surfaces of said microporous membrane in a sym. manner in relation to said membrane: a layer forming a reflecting electrode, an electrochromic conductive polymer layer, and a flexible transparent window at wavelengths ranging from (0,35) and (20) μm .

IT 9002-84-0, Poly(tetrafluoroethylene)
(electrochromic device with)

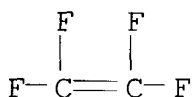
RN 9002-84-0 HCA

CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

CMF C2 F4



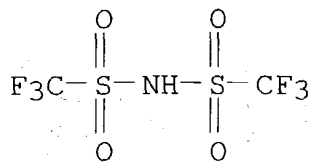
IT 82113-65-3, Bis((trifluoromethyl)sulfonyl)
imide 90076-65-6, Lithium bis((trifluoromethyl)
sulfonyl)imide

(electrolyte; electrochromic device with)

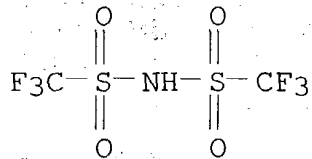
RN 82113-65-3 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-

(9CI) (CA INDEX NAME)



RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-,
lithium salt (9CI) (CA INDEX NAME)

● Li

IC ICM G02F

CC 73-11 (Optical, Electron, and Mass Spectroscopy and Other Related
Properties)

Section cross-reference(s): 36

IT Conducting polymers
Electrochromic devices
Electrodes**Electrolytes**

Heat transfer

Optical reflectors

(electrochromic device with)

IT Sulfonic acids, uses

(salts, **electrolyte**; electrochromic device with)IT 1576-84-7 **9002-84-0**, Poly(tetrafluoroethylene)

9002-86-2, Poly(vinyl chloride) 9002-88-4, Polyethylene

9002-89-5, Poly(vinyl alcohol) 9003-07-0, Polypropylene

9003-29-6, Polybutylene 9003-42-3, Poly(ethylmethacrylate)

9010-79-1D, fluorinated 9011-14-7, PMMA 25038-59-9, Polyethylene
terephthalate, uses 25322-68-3, Poly(ethylene glycol)

30396-85-1, Acrylonitrile-methyl methacrylate copolymer

(electrochromic device with)

IT 96-48-0, Butyrolactone 96-49-1, Ethylene carbonate 108-32-7,

Propylene carbonate 111-96-6, Diglyme 616-38-6, Dimethyl

carbonate 17009-90-4D, Imidazolium, cations **82113-65-3**,

Bis((trifluoromethyl)sulfonyl)imide
 90076-65-6, Lithium bis((trifluoromethyl)sulfonyl)
 imide
 (electrolyte; electrochromic device with)

L121 ANSWER 6 OF 22 HCA COPYRIGHT 2004 ACS on STN
 136:234744 Liquid **electrolyte** lithium-sulfur batteries. Katz,
 Bruce D.; Chu, May-Ying; Dejonghe, Lutgard C.; Visco, Steven J.
 (Polyplus Battery Company, USA). U.S. US 6358643 B1 20020319, 30
 pp., Cont.-in-part of U.S. 6,030,720. (English). CODEN: USXXAM.
 APPLICATION: US 2000-495639 20000201. PRIORITY: US 1994-344384
 19941123; US 1995-479687 19950607; US 1996-686609 19960726; US
 1997-948969 19971010.

AB A high performance lithium-sulfur battery cell includes the
 following features: (a) a neg. electrode including a metal or an ion
 of the metal; (b) a pos. electrode comprising an electronically
 conductive material; and (c) a liq. catholyte including a solvent
 and dissolved **electrochem.** active material comprising
 sulfur in the form of at least one of a sulfide of the metal and a
 polysulfide of the metal. Such battery cells are characterized by
 an energy d., calcd. based upon a laminate wt. of at least about 400
 W-h/kg when discharged at a rate of at least 0.1 mA/cm². Cells
 meeting these criteria often find use as primary cells.

IT 9002-84-0, Teflon 90076-65-6, Lithium bis(
trifluoromethanesulfonyl)imide
 (liq. **electrolyte** lithium-sulfur batteries)

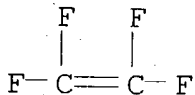
RN 9002-84-0 HCA

CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

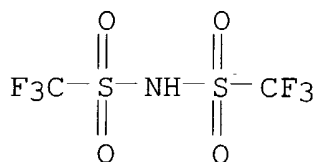
CRN 116-14-3

CMF C2 F4



RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-,
 lithium salt (9CI) (CA INDEX NAME)



● Li

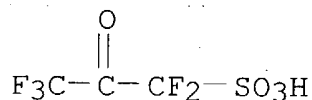
- IC ICM H01M010-36
ICS H01M010-40
- NCL 429105000
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
- ST lithium sulfur battery liq **electrolyte**
- IT Polysulfides
Sulfides, uses
(liq. **electrolyte** lithium-sulfur batteries)
- IT Alkali metals, uses
Carbon black, uses
Fluoropolymers, uses
Polyoxyalkylenes, uses
(liq. **electrolyte** lithium-sulfur batteries)
- IT Primary batteries
Secondary batteries
(lithium; liq. **electrolyte** lithium-sulfur batteries)
- IT 110-71-4 143-24-8, Tetraglyme 646-06-0, Dioxolane 7439-93-2,
Lithium, uses 7440-23-5, Sodium, uses 7704-34-9, Sulfur, uses
(liq. **electrolyte** lithium-sulfur batteries)
- IT 7440-44-0, Carbon, uses 9002-84-0, Teflon 25322-68-3,
Peo 90076-65-6, Lithium bis(
trifluoromethanesulfonyl)imide
(liq. **electrolyte** lithium-sulfur batteries)
- IT 75-05-8, Acetonitrile, uses
(liq. **electrolyte** lithium-sulfur batteries)
- L121 ANSWER 7 OF 22 HCA COPYRIGHT 2004 ACS on STN
- 135:333324 High-proton-conductive styrene-grafted fluoropolymer
electrolyte for battery membranes. Kawakado, Masaya;
Morimoto, Tomo; Hasegawa, Naoki; Kamiya, Atsushi; Yamada, Chiaki;
Kato, Mitsuaki; Akakabe, Michio (Toyota Central Research and
Development Laboratories, Inc., Japan; Aishin Seiki Co., Ltd.).
Jpn. Kokai Tokkyo Koho JP 2001302721 A2 20011031, 9 pp. (Japanese).
CODEN: JKXXAF. APPLICATION: JP 2000-121892 20000424.
- AB The **electrolyte** esp. for battery membranes consists of
hydrocarbon graft polymers and super acid groups with ion exchange

capacity (IEC) ≥ 1.2 meq/g. Prepg. a 17- μ m ethylene-tetrafluoroethylene copolymer membrane, grafting with styrene under electron beam irradiation, and reaction with 2-ketopentafluoropropanesulfonic acid gave a 0.033-mm sulfonated membrane with $\text{C}(\text{CF}_3)\text{OHCF}_2\text{SO}_3\text{H}$ group, showing IEC 1.73 meq/g and cond. 0.32 S/cm at RH 100%.

IT **53841-62-6DP**, 2-Ketopentafluoropropanesulfonic acid, reaction product with ethylene-styrene-tetrafluoroethylene graft copolymer **84246-31-1DP**, reaction product with ethylene-styrene-tetrafluoroethylene graft copolymer, sulfonated **197895-58-2DP**, Ethylene-styrene-tetrafluoroethylene graft copolymer, chloromethylated, aminated, reaction product with sulfonyl fluoride-terminated imides **370553-55-2DP**, reaction product with ethylene-styrene-tetrafluoroethylene graft copolymer, sulfonated (high-proton-conductive styrene-grafted fluoropolymer electrolyte for battery membranes)

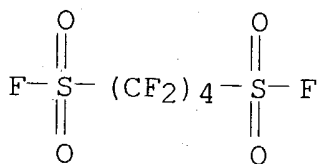
RN 53841-62-6 HCA

CN 1-Propanesulfonic acid, 1,1,3,3,3-pentafluoro-2-oxo- (9CI) (CA INDEX NAME)



RN 84246-31-1 HCA

CN 1,4-Butanedisulfonyl difluoride, 1,1,2,2,3,3,4,4-octafluoro- (9CI) (CA INDEX NAME)



RN 197895-58-2 HCA

CN Benzene, ethenyl-, polymer with ethene and tetrafluoroethene, graft (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

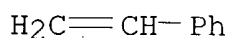
CMF C2 F4



CM 2

CRN 100-42-5

CMF C8 H8



CM 3

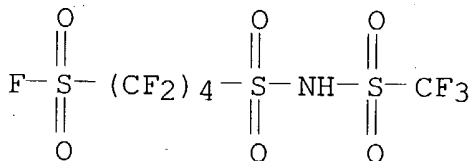
CRN 74-85-1

CMF C2 H4



RN 370553-55-2 HCA

CN 1-Butanesulfonyl fluoride, 1,1,2,2,3,3,4,4-octafluoro-4-
 [[[trifluoromethyl)sulfonyl]amino]sulfonyl]- (9CI) (CA INDEX NAME)



IC ICM C08F008-38

ICS C08F259-08; H01B001-06; H01M008-02; H01M008-10

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38

ST styrene grafted fluoropolymer **electrolyte** battery
 membrane; ethylene tetrafluoroethylene styrene graft copolymer
 sulfonated **electrolyte** battery

IT **Fuel cells**

(**electrolyte** membranes; high-proton-conductive
 styrene-grafted fluoropolymer **electrolyte** for battery
 membranes)

IT Polyelectrolytes

Secondary battery separators

- (high-proton-conductive styrene-grafted fluoropolymer **electrolyte** for battery membranes)
- IT Fluoropolymers, uses
(polystyrene-grafted, sulfonated; high-proton-conductive styrene-grafted fluoropolymer **electrolyte** for battery membranes)
- IT 375-50-8DP, 1,4-Diiodooctafluorobutane, reaction product with ethylene-styrene-tetrafluoroethylene graft copolymer, sulfonated **53841-62-6DP**, 2-Ketopentafluoropropanesulfonic acid, reaction product with ethylene-styrene-tetrafluoroethylene graft copolymer **84246-31-1DP**, reaction product with ethylene-styrene-tetrafluoroethylene graft copolymer, sulfonated **197895-58-2DP**, Ethylene-styrene-tetrafluoroethylene graft copolymer, chloromethylated, aminated, reaction product with **sulfonyl** fluoride-terminated **imides** **197895-58-2DP**, Ethylene-styrene-tetrafluoroethylene graft copolymer, chloromethylated, aminated, reaction product with sulfonyl fluoride-terminated perfluorobutane **197895-58-2DP**, Ethylene-styrene-tetrafluoroethylene graft copolymer, difluoromethylsulfonated **197895-58-2DP**, Ethylene-styrene-tetrafluoroethylene graft copolymer, octafluorobutylsulfonated **197895-58-2DP**, Ethylene-styrene-tetrafluoroethylene graft copolymer, reaction product with 2-ketopentafluoropropanesulfonic acid **370553-55-2DP**, reaction product with ethylene-styrene-tetrafluoroethylene graft copolymer, sulfonated
(high-proton-conductive styrene-grafted fluoropolymer **electrolyte** for battery membranes)

L121 ANSWER 8 OF 22 HCA COPYRIGHT 2004 ACS on STN

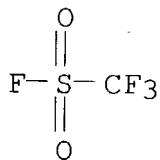
135:182624 Perfluoropolymer substrates coated with fluoropolymers crosslinked with perfluoro functional groups for preparation of membranes with hydrophilic surfaces. Moya, Wilson (Millipore Corporation, USA). PCT Int. Appl. WO 2001058577 A1 20010816, 54 pp. DESIGNATED STATES: W: CA, CN, JP, KR, SG, US; RW: DE, FR, GB, IT, NL. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US3129 20010131. PRIORITY: US 2000-PV181947 20000211.

- AB Porous or non-porous filters or filtration membranes are comprised of a perfluoropolymer substrate with a modified hydrophilic surface that is prepd. by crosslinking with a polymeric fluorocarbon having hydrophilic functional contg. intervening fluorinated or perfluorinated crosslinking groups. The crosslinking groups are selected from one or two of sulfonyl methide, sulfonylmethane, amide, sulfonamide, imide, and sulfonimide groups. Suitable polymer components are selected from vinyl fluoride, hexafluoropropylene, vinylidene fluoride, trifluoroethylene, chlorotrifluoroethylene, perfluoro(alkyl vinyl ethers), and tetrafluoroethylene. A hydrophilic but water-impermeable polymer coating on a

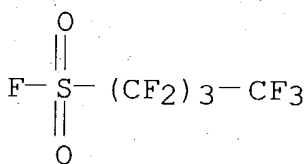
perfluorocarbon substrate was prepd. by coating the substrate (e.g., PTFE or FEP) with tetrafluoroethylene-perfluoro(2-vinyloxyethanesulfonyl fluoride) copolymer that was reacted sequentially with: (1) anhyd. ammonia to form the sulfonamide-terminated copolymer, and (2) CF₃(CF₂)₃SO₂F or FO₂S-(CH₂)₄-SO₂F to form the sulfonimide-terminated copolymer. Such membranes are hydrophilic yet chem. inert to corrosive and aggressive media.

IT 335-05-7DP, Trifluoromethanesulfonyl fluoride, reaction products with sulfonamide-terminated perfluoropolymers
 375-72-4DP, Perfluorobutanesulfonyl fluoride, reaction products with sulfonamide-terminated perfluoropolymers
 7664-41-7DP, Ammonia, reaction products with sulfonyl fluoride-terminated perfluoropolymers, reactions (in prepn. of fluoropolymers crosslinked with perfluoro functional groups for prepn. of membranes with hydrophilic surfaces)

RN 335-05-7 HCA
 CN Methanesulfonyl fluoride, trifluoro- (6CI, 8CI, 9CI) (CA INDEX NAME)



RN 375-72-4 HCA
 CN 1-Butanesulfonyl fluoride, 1,1,2,2,3,3,4,4,4-nonafluoro- (8CI, 9CI) (CA INDEX NAME)



RN 7664-41-7 HCA
 CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH₃

IT 355136-36-6D, Nafion NE 105F, sequential reaction products with ammonia and perfluorobutanesulfonyl chloride or perfluorobutane-1,4-bis(sulfonyl chloride)

(membranes; perfluoropolymer substrates coated with fluoropolymers crosslinked with perfluoro functional groups for prepn. of membranes with hydrophilic surfaces)

RN 355136-36-6 HCA

CN Nafion NE 105F (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 69462-70-0D, sequential reaction products with ammonia and trifluoromethanesulfonyl fluoride or perfluorobutanesulfonyl chloride or perfluorobutane-1,4-bis(sulfonyl chloride)

(membranes; perfluoropolymer substrates coated with fluoropolymers crosslinked with perfluoro functional groups for prepn. of membranes with hydrophilic surfaces)

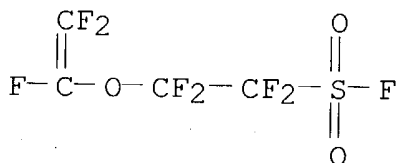
RN 69462-70-0 HCA

CN Ethanesulfonyl fluoride, 1,1,2,2-tetrafluoro-2-[(trifluoroethenyl)oxy]-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 29514-94-1

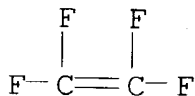
CMF C4 F8 O3 S



CM 2

CRN 116-14-3

CMF C2 F4



IC ICM B01D067-00

ICS B01D071-32; C08J005-22

CC 48-1 (Unit Operations and Processes)

Section cross-reference(s): 38

IT 335-05-7DP, Trifluoromethanesulfonyl fluoride, reaction products with sulfonamide-terminated perfluoropolymers
375-72-4DP, Perfluorobutanesulfonyl fluoride, reaction

products with sulfonamide-terminated perfluoropolymers
7664-41-7DP, Ammonia, reaction products with
sulfonyl fluoride-terminated perfluoropolymers, reactions
122983-41-9P, 1,4-Butanedisulfonyl difluoride
(in prepn. of fluoropolymers crosslinked with perfluoro
functional groups for prepn. of membranes with hydrophilic
surfaces)

IT 355136-36-6D, Nafion NE 105F, sequential reaction
products with ammonia and perfluorobutanesulfonyl chloride
or perfluorobutane-1,4-bis(sulfonyl chloride)
(membranes; perfluoropolymer substrates coated with
fluoropolymers crosslinked with perfluoro functional groups for
prepn. of membranes with hydrophilic surfaces)

IT 69462-70-0D, sequential reaction products with
ammonia and trifluoromethanesulfonyl fluoride or
perfluorobutanesulfonyl chloride or perfluorobutane-1,4-bis(sulfonyl
chloride)
(membranes; perfluoropolymer substrates coated with
fluoropolymers crosslinked with perfluoro functional groups for
prepn. of membranes with hydrophilic surfaces)

L121 ANSWER 9 OF 22 HCA COPYRIGHT 2004 ACS on STN.

135:95187 High strength carbon anode for a rechargeable lithium ion
battery. Vaidyanathan, Hariharan; Willstaedt, Eric B.; Earl, Martin
W. (Comsat Corporation, USA). PCT Int. Appl. WO 2001052335 A2
20010719, 22 pp. DESIGNATED STATES: W: JP; RW: AT, BE, CH, CY, DE,
DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR. (English).
CODEN: PIXXD2. APPLICATION: WO 2001-US12 20010116. PRIORITY: US
2000-488388 20000114.

AB The present invention is directed to a platinum-contg. carbon-contg.
anode for a rechargeable lithium ion **electrochem.** cell.
The anode is comprised of large surface area carbon material that
has been coated with platinum mols. The integrity of the anode is
maintained through the use of one of two binding agents, either
Teflon or polyvinylidene fluoride. In conjunction with a lithium
cobalt oxide cathode and a Celgard separator, the anode forms an
electrode sandwich. The electrode sandwich, in turn, comprises a
rechargeable lithium ion **electrochem.** cell composed of the
electrode sandwich wetted by an **electrolyte** compn., contg.
LiPF₆ dissolved in equal parts EC and DMC, within a sealed
container. The resulting rechargeable lithium ion
electrochem. cell exhibits a capacity at the theor. limit
for carbon, namely 372 mAh/g. Furthermore, the resulting
rechargeable lithium ion **electrochem.** cell exhibits the
same high capacity upon repeated cycling.

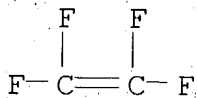
IT 9002-84-0, Teflon
(binder; high strength carbon anode for rechargeable lithium ion
battery)

RN 9002-84-0 HCA
 CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

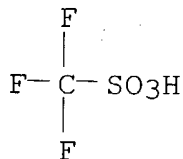
CMF C2 F4



IT 33454-82-9, Lithium triflate 90076-65-6, Lithium bis(trifluoromethylsulfonyl) imide
 131651-65-5, Lithium perfluorobutanesulfonate
 (high strength carbon anode for rechargeable lithium ion battery)

RN 33454-82-9 HCA

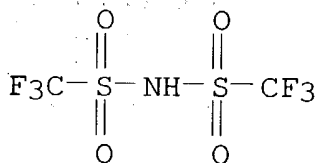
CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



● Li

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

RN 131651-65-5 HCA

CN 1-Butanesulfonic acid, 1,1,2,2,3,3,4,4,4-nonafluoro-, lithium salt
(9CI) (CA INDEX NAME)

HO₃S-(CF₂)₃-CF₃

● Li

IC ICM H01M004-00
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
IT 9002-84-0, Teflon 24937-79-9, Polyvinylidene fluoride
(binder; high strength carbon anode for rechargeable lithium ion battery)
IT 96-49-1, Ethylene carbonate 616-38-6, Dimethyl carbonate 7440-06-4, Platinum, uses 7440-44-0, Carbon, uses 7791-03-9, Lithium perchlorate 14024-11-4, Lithium tetrachloroaluminate 14283-07-9, Lithium tetrafluoroborate 21324-40-3, Lithium hexafluorophosphate 29935-35-1, Lithium hexafluoroarsenate 33454-82-9, Lithium triflate 39300-70-4, Lithium nickel oxide 39457-42-6, Lithium manganese oxide 52627-24-4, Cobalt lithium oxide 65324-39-2, celgard 2400 90076-65-6, Lithium bis(trifluoromethylsulfonyl) imide 131651-65-5, Lithium perfluorobutanesulfonate 132404-42-3 (high strength carbon anode for rechargeable lithium ion battery)

L121 ANSWER 10 OF 22 HCA COPYRIGHT 2004 ACS on STN

134:281303 Preparation of fluorocarbon polymeric compositions having hydrophilic functional groups and process therefor. Moya, Wilson (Millipore Corporation, USA). PCT Int. Appl. WO 2001027167 A1 20010419, 53 pp. DESIGNATED STATES: W: CA, CN, JP, KR, SG, US; RW: DE, FR, GB, IT, NL. (English). CODEN: PIXXD2. APPLICATION: WO 2000-US28019 20001010. PRIORITY: US 1999-PV158941 19991012.

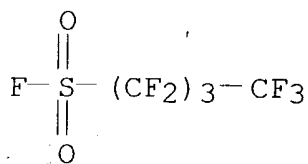
AB A crosslinked fluorocarbon such as perfluorocarbon, polymeric compn. is provided having hydrophilic functional groups, which is crosslinked with fluorinated such as perfluorinated crosslinking groups. Also provided is a branched fluorocarbon such as perfluorocarbon, polymeric compn. having hydrophilic functional groups. This invention further provides for the first time a crosslinked fluorocarbon, preferably perfluorinated, polymeric compn. having hydrophilic functional groups, which is crosslinked with fluorinated crosslinking groups, formed from a fluorocarbon polymer precursor, which is thermally and chem. stable and which can be rendered more hydrophilic than its fluorocarbon polymer precursor.

IT 375-72-4, Perfluorobutanesulfonyl fluoride
84246-31-1, Perfluorobutane-1,4-disulfonyl fluoride

(in prepn. of fluorocarbon polymeric compns. having hydrophilic functional groups)

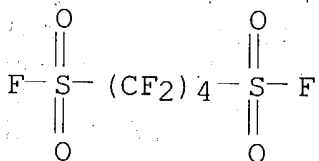
RN 375-72-4 HCA

CN 1-Butanesulfonyl fluoride, 1,1,2,2,3,3,4,4,4-nonafluoro- (8CI, 9CI)
(CA INDEX NAME)



RN 84246-31-1 HCA

CN 1,4-Butanedisulfonyl difluoride, 1,1,2,2,3,3,4,4-octafluoro- (9CI)
(CA INDEX NAME)



IT 7664-41-7DP, Ammonia, reaction product with
Nafion 105, preparation 162774-80-3DP,
Nafion 105, reaction product with ammonia
(prepn. of fluorocarbon polymeric compns. having hydrophilic functional groups)

RN 7664-41-7 HCA

CN Ammonia (8CI, 9CI) (CA INDEX NAME)

NH₃

RN 162774-80-3 HCA

CN Nafion 105 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC ICM C08F008-00

ICS C08J005-22; C08J007-12

CC 35-8 (Chemistry of Synthetic High Polymers)

Section cross-reference(s): 38

IT 375-72-4, Perfluorobutanesulfonyl fluoride

84246-31-1, Perfluorobutane-1,4-disulfonyl fluoride

(in prepn. of fluorocarbon polymeric compns. having hydrophilic functional groups)

IT 7664-41-7DP, Ammonia, reaction product with

Nafion 105, preparation 162774-80-3DP,

Nafion 105, reaction product with ammonia
(prepn. of fluorocarbon polymeric compns. having hydrophilic
functional groups)

L121 ANSWER 11 OF 22 HCA COPYRIGHT 2004 ACS on STN

134:210510 **Solid polymer electrolytes.**

Munshi, M. Zafar A. (Lithium Power Technologies, Inc., USA). PCT
Int. Appl. WO 2001017051 A1 20010308, 52 pp. DESIGNATED STATES: W:
AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR,
CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID,
IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA,
MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI,
SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY,
KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY,
DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT,
SE, SN, TD, TG. (English). CODEN: PIXXD2. APPLICATION: WO
2000-US22915 20000821. PRIORITY: US 1999-388741 19990902.

AB A wide range of **solid polymer electrolytes** characterized by high ionic cond. at room temp., and below, are disclosed. These all-solid-state **polymer electrolytes** are suitable for use in **electrochem.** cells and batteries. A preferred polymer **electrolyte** is a cationic conductor which is flexible, dry, non-tacky, and lends itself to economical manuf. in very thin film form. **Solid polymer electrolyte** compns. which exhibit a cond. of at least approx. 10^{-3} - 10^{-4} S/cm at 25° comprise a base polymer or polymer blend contg. an elec. conductive polymer, a metal salt, a finely divided inorg. filler material, and a finely divided ion conductor. The new **solid polymer electrolytes** are combinable with various neg. electrodes such as an alkali metal, alk. earth metal, transition metal, ion-insertion polymers, ion-insertion inorg. electrodes, carbon insertion electrodes, tin oxide electrode, among others, and various pos. electrodes such as ion-insertion polymers and ion-insertion inorg. electrodes to provide batteries and supercapacitors having high specific energy (Wh/kg) (gravimetric) and energy d. (Wh/L) (volumetric), high cycle life, low self-discharge and providing improved safety.

IT 9002-84-0, Ptfе
(manuf. of **solid polymer electrolytes**
for **electrochem.** cells)

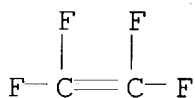
RN 9002-84-0 HCA

CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

CMF C2 F4

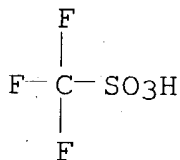


IT 33454-82-9, Lithium trifluoromethanesulfonate
 90076-65-6, Lithiumbis(trifluoromethanesulfonyl)
 imide

(manuf. of solid polymer electrolytes
 for electrochem. cells)

RN 33454-82-9 HCA

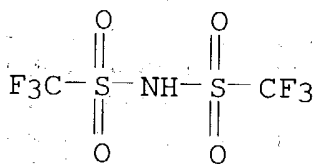
CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX
 NAME)



● Li

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-,
 lithium salt (9CI) (CA INDEX NAME)



● Li

IC ICM H01M010-40

ICS H01G009-02; H01B001-12; H01M004-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38, 76

ST battery electrolyte solid polymer;
 safety battery electrolyte solid polymer
 ; supercapacitor electrolyte solid

polymer

- IT Polymers, uses
(block; manuf. of **solid polymer electrolytes** for **electrochem. cells**)
- IT Polymers, uses
(co-; manuf. of **solid polymer electrolytes** for **electrochem. cells**)
- IT Phosphate glasses
- Sulfide glasses
(ion conductor; manuf. of **solid polymer electrolytes** for **electrochem. cells**)
- IT Secondary batteries
(lithium; manuf. of **solid polymer electrolytes** for **electrochem. cells**)
- IT Battery **electrolytes**
Ionic conductors
Polymer **electrolytes**
Polymer networks
(manuf. of **solid polymer electrolytes** for **electrochem. cells**)
- IT Acrylic polymers, uses
Fluoropolymers, uses
Polycarbonates, uses
Polyesters, uses
Polymers, uses
Polyoxyalkylenes, uses
Polysiloxanes, uses
Polythiophenylenes
(manuf. of **solid polymer electrolytes** for **electrochem. cells**)
- IT Capacitors
(supercapacitors; manuf. of **solid polymer electrolytes** for **electrochem. cells**)
- IT 7631-86-9, Fumed silica, uses
(colloidal, filler; manuf. of **solid polymer electrolytes** for **electrochem. cells**)
- IT 1344-28-1, Alumina, uses
(filler; manuf. of **solid polymer electrolytes** for **electrochem. cells**)
- IT 10377-51-2, Lithium iodide 12007-33-9, Boron sulfide b_2s_3
12136-58-2, Lithium sulfide li_2s
(glass; manuf. of **solid polymer electrolytes** for **electrochem. cells**)
- IT 12627-14-4, Lithium silicate 184905-46-2, Lithium nitrogen
phosphorus oxide
(ion conductor; manuf. of **solid polymer electrolytes** for **electrochem. cells**)
- IT 7439-93-2, Lithium, uses 7439-93-2D, Lithium, complex with

polymer, uses 9002-83-9, Poly(chlorotrifluoroethylene)
9002-84-0, Ptfе 9002-86-2, Polyvinyl chloride 9003-07-0,
 Polypropylene 9010-79-1D, Ethylene-propylene copolymer,
 fluorinated 9011-14-7, Pmma 24937-79-9, Pvdф 25067-61-2,
Polymethacrylonitrile 25101-45-5, Ethylene-
 chlorotrifluoroethylene **copolymer** 25322-68-3, Peo
 132404-42-3

(manuf. of **solid polymer electrolytes**
 for **electrochem.** cells)

IT 329028-78-6P

(manuf. of **solid polymer electrolytes**
 for **electrochem.** cells)

IT 7439-93-2D, Lithium, salt, uses 7439-95-4D; Magnesium, salt, uses
 7440-09-7D, Potassium, salt, uses 7440-23-5D, Sodium, salt, uses
 7440-70-2D, Calcium, salt, uses 7791-03-9, Lithium perchlorate
 14024-11-4, Lithium tetrachloroaluminate 14283-07-9, Lithium
 tetrafluoroborate 21324-40-3, Lithium hexafluorophosphate
 29935-35-1, Lithium hexafluoroarsenate **33454-82-9**, Lithium
 trifluoromethanesulfonate **90076-65-6**, Lithiumbis(
trifluoromethanesulfonyl)imide

(manuf. of **solid polymer electrolytes**
 for **electrochem.** cells)

IT 329028-80-0

(manuf. of **solid polymer electrolytes**
 for **electrochem.** cells)

IT 947-19-3, Irgacure 184

(photoinitiator; manuf. of **solid polymer**
electrolytes for **electrochem.** cells)

IT 37220-89-6, Lithium- β -alumina

(β -type, ion conductor; manuf. of **solid**
polymer electrolytes for **electrochem.**
 cells)

L121 ANSWER 12 OF 22 HCA COPYRIGHT 2004 ACS on STN

134:74037 Improved lithium ion polymer **electrolytes** and
 methods of manufacturing an **electrochemical** cell. Munshi,
 M. Zafar A. (Lithium Power Technologies, Inc., USA). PCT Int. Appl.
 WO 2001001507 A1 20010104, 43 pp. DESIGNATED STATES: W: AU, BR,
 CA, CN, ID, IL, IN, JP, KR, MX, SG, VN; RW: AT, BE, CH, CY, DE, DK,
 ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE. (English). CODEN:
 PIXXD2. APPLICATION: WO 2000-US16294 20000626. PRIORITY: US
 1999-340944 19990628.

AB A dimensionally stable, highly resilient, hybrid **copolymer**
solid-soln. electrolyte-retention film for use in
 a lithium ion battery in one preferred embodiment has a
 predominantly amorphous structure and mech. strength despite contact
 with liq. solvent **electrolyte**. The film is a thinned
 (stretched), cast film of a homogeneous blend of two or more

polymers, one of which is selected for its pronounced solvent retention properties. A very high surface area inorg. filler dispersed in the blend during formation thereof serves to increase the porosity of the film and thereby enhance **electrolyte** retention. The film is soaked in a soln. of liq. polymer with liq. org. solvent **electrolyte** and lithium salt, for absorption thereof. Use of a crosslinked liq. polymer enhances trapping of mols. of the **electrolyte** into pores of the film. The **electrolyte** film is sandwiched between flexible active anode and cathode layers to form the lithium ion battery. Novel methods are provided for forming the electrodes, the polymer substrate, and other elements of the battery.

IT 9002-84-0, Ptfе
(improved lithium ion polymer **electrolytes** and methods of manufg. **electrochem.** cell)

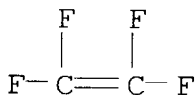
RN 9002-84-0 HCA

CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

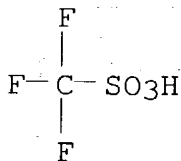
CMF C2 F4



IT 33454-82-9, Lithium triflate 90076-65-6, Lithium bis(trifluoromethanesulfonyl)imide
(improved lithium ion polymer **electrolytes** and methods of manufg. **electrochem.** cell)

RN 33454-82-9 HCA

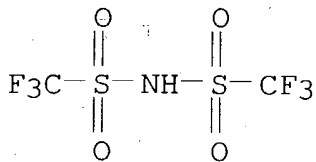
CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



● Li

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

- IC ICM H01M006-18
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 38
- ST battery lithium ion polymer **electrolyte**
- IT Conducting polymers
(Li-doped; improved lithium ion polymer **electrolytes**
and methods of manufg. **electrochem.** cell)
- IT Polyacetylenes, uses
Polyanilines
(Li-doped; improved lithium ion polymer **electrolytes**
and methods of manufg. **electrochem.** cell)
- IT Battery **electrolytes**
Electron beams
Polymer **electrolytes**
UV radiation
(improved lithium ion polymer **electrolytes** and methods
of manufg. **electrochem.** cell)
- IT Acrylic polymers, uses
Fluoropolymers, uses
Polycarbonates, uses
Polyesters, uses
Polyoxyalkylenes, uses
Polysiloxanes, uses
Polythiophenylenes
(improved lithium ion polymer **electrolytes** and methods
of manufg. **electrochem.** cell)
- IT Secondary batteries
(lithium; improved lithium ion polymer **electrolytes** and
methods of manufg. **electrochem.** cell)
- IT Polyoxyalkylenes, uses
(oxymethylene-linked; improved lithium ion polymer
electrolytes and methods of manufg. **electrochem.**
cell)
- IT Urethanes

- (trifunctional, crosslinking agent; improved lithium ion polymer **electrolytes** and methods of manufg. **electrochem** cell)
- IT 25067-58-7, Polyacetylene 25233-30-1, Polyaniline 30604-81-0, Polypyrrole
(Li-doped; improved lithium ion polymer **electrolytes** and methods of manufg. **electrochem.** cell)
- IT 7631-86-9, Fumed silica, uses
(colloidal, filler; improved lithium ion polymer **electrolytes** and methods of manufg. **electrochem** cell)
- IT 7429-90-5, Aluminum, uses 7440-02-0, Nickel, uses 7440-50-8, Copper, uses 7440-66-6, Zinc, uses 12597-68-1, Stainless steel, uses
(current collector; improved lithium ion polymer **electrolytes** and methods of manufg. **electrochem** cell)
- IT 1344-28-1, Alumina, uses
(filler; improved lithium ion polymer **electrolytes** and methods of manufg. **electrochem.** cell)
- IT 1332-29-2, Tin oxide 7440-44-0D, Carbon, intercalation compds., uses 9002-84-0, Ptfе 9003-07-0, Polypropylene 9003-11-6, Ethylene oxide-propylene oxide copolymer 9011-14-7, Pmma 11126-15-1, Lithium vanadium oxide 12057-17-9, Lithium manganese oxide LiMn2O4 12423-04-0, Lithium vanadium oxide LiV3O8 24937-79-9, Pvdф 24968-11-4, Polyethylene naphthalate 25014-41-9, Polyacrylonitrile 25038-59-9, Polyethylene terephthalate, uses 25067-61-2, Polymethacrylonitrile 25230-87-9 25322-68-3, Peo 25322-68-3D, Peo, oxymethylene-linked 30871-57-9, Propylene-vinylidene fluoride copolymer 39300-70-4, Lithium nickel oxide 39457-42-6, Lithium manganese oxide 52627-24-4, Cobalt lithium oxide 61673-65-2, Lithium niobium selenide 74245-06-0, Lithium vanadium sulfide 98973-15-0 131344-56-4, Cobalt lithium nickel oxide 136511-06-3, Meep 162684-16-4, Lithium manganese nickel oxide 214536-41-1, Cobalt lithium manganese oxide
(improved lithium ion polymer **electrolytes** and methods of manufg. **electrochem.** cell)
- IT 96-49-1, Ethylene carbonate 105-58-8, Diethyl carbonate 108-32-7, Propylene carbonate 616-38-6, Dimethyl carbonate 7791-03-9, Lithium perchlorate 14024-11-4, Lithium tetrachloroaluminate 14283-07-9, Lithium tetrafluoroborate 21324-40-3, Lithium hexafluorophosphate 29935-35-1, Lithium hexafluoroarsenate 33454-82-9, Lithium triflate 90076-65-6, Lithium bis(trifluoromethanesulfonyl) imide 132404-42-3
(improved lithium ion polymer **electrolytes** and methods of manufg. **electrochem.** cell)

L121 ANSWER 13 OF 22 HCA COPYRIGHT 2004 ACS on STN

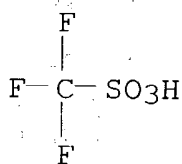
131:245572 Polymer **electrolyte** solvent for secondary batteries. Denton, Frank R., III (Motorola, Inc., USA) U.S. US 5962168 A 19991005, 5 pp., Cont.-in-part of U.S. Ser. No. 781,255. (English). CODEN: USXXAM. APPLICATION: US 1998-66656 19980427. PRIORITY: US 1997-781255 19970110.

AB An **electrochem.** cell, esp. a lithium secondary battery, consists of an **electrolyte** system between first and second electrodes, where the **electrolyte** system includes a polymeric support filled with a solvent contg. dispersed **electrolyte** active species (alkali metal salts). The solvent comprises a polyvinylidene fluoride with no. av. mol. wt. $\leq 50,000$ amu. Alternatively, the solvent may be a blend or copolymer of polyvinylidene fluoride and another solvent or polymer.

IT 1493-13-6D, Trifluoromethylsulfonic acid, alkali metal salts 25190-89-0, Hexafluoropropene-tetrafluoroethene-vinylidene fluoride copolymer 25684-76-8, Tetrafluoroethene-vinylidene fluoride copolymer 60805-12-1D, Methane, tris(trifluoromethylsulfonyl), alkali metal salts 82113-65-3D, Bis(trifluoromethylsulfonyl) imide, alkali metal salts (polymer **electrolyte** solvent for secondary batteries)

RN 1493-13-6 HCA

CN Methanesulfonic acid, trifluoro- (6CI, 7CI, 8CI, 9CI) (CA INDEX NAME)



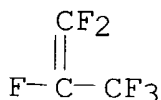
RN 25190-89-0 HCA

CN 1-Propene, 1,1,2,3,3,3-hexafluoro-, polymer with 1,1-difluoroethene and tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 116-15-4

CMF C3 F6



CM 2

CRN 116-14-3

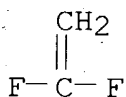
CMF C2 F4



CM 3

CRN 75-38-7

CMF C2 H2 F2



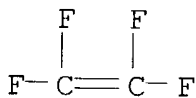
RN 25684-76-8 HCA

CN Ethene, tetrafluoro-, polymer with 1,1-difluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

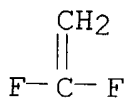
CMF C2 F4



CM 2

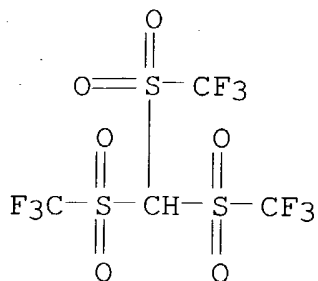
CRN 75-38-7

CMF C2 H2 F2



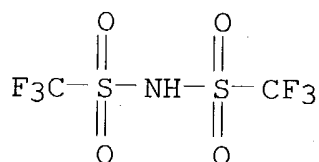
RN 60805-12-1 HCA

CN Methane, tris[(trifluoromethyl)sulfonyl]- (9CI) (CA INDEX NAME)



RN 82113-65-3 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]- (9CI) (CA INDEX NAME)



IC ICM H01M010-40

NCL 429303000

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 37

ST secondary battery solid **electrolyte** solvent; lithium
secondary battery solid **electrolyte** solvent; gel
electrolyte solvent secondary battery; polyvinylidene
fluoride gel **electrolyte** solvent battery

IT Solid **electrolytes**
(gel **electrolytes**; polymer **electrolyte**
solvent for secondary batteries)

IT Secondary batteries
(lithium; polymer **electrolyte** solvent for secondary
batteries)

IT Battery **electrolytes**
Secondary batteries
Solvents
(polymer **electrolyte** solvent for secondary batteries)

IT Acrylic polymers, uses
Alkali metal bromides
Alkali metal chlorides
Alkali metal iodides
Fluoropolymers, uses
Polyesters, uses

Polyoxyalkylenes, uses

Polyphosphazenes

Polysiloxanes, uses

(polymer **electrolyte** solvent for secondary batteries)

- IT 64-19-7D, Acetic acid, alkali metal salts, uses 67-68-5,
 Dimethylsulfoxide, uses 75-05-8, Acetonitrile, uses 96-49-1,
 Ethylene carbonate 105-58-8, Diethyl carbonate 108-32-7,
 Propylene carbonate 109-99-9, uses 110-71-4 616-38-6, Dimethyl
 carbonate 623-96-1, Dipropylcarbonate 872-50-4,
 N-Methyl-2-pyrrolidone, uses **1493-13-6D**,
 Trifluoromethylsulfonic acid, alkali metal salts 7601-90-3D,
 Perchloric acid, alkali metal salts, uses 9002-86-2,
 Polyvinylchloride 9002-89-5, Polyvinylalcohol 9002-98-6
 9003-05-8, Polyacrylamide 9003-20-7, Polyvinylacetate 9003-39-8,
 Polyvinylpyrrolidone 9003-47-8, Polyvinylpyridine 9011-17-0,
 Hexafluoropropene-vinylidene fluoride copolymer 16872-11-0D,
 Tetrafluoroboric acid, alkali metal salts 16940-81-1D,
 Hexafluorophosphoric acid, alkali metal salts 16950-06-4D,
 Hexafluoroantimonic acid, alkali metal salts 17068-85-8D,
 Hexafluoroarsenic acid, alkali metal salts 24937-79-9
 24979-97-3, Polytetrahydrofuran 25014-41-9, Polyacrylonitrile
25190-89-0, Hexafluoropropene-tetrafluoroethene-vinylidene
 fluoride copolymer 25322-68-3 **25684-76-8**,
 Tetrafluoroethene-vinylidene fluoride copolymer 25747-73-3,
 Polyvinylene carbonate **60805-12-1D**, Methane,
 tris(trifluoromethylsulfonyl), alkali metal salts
82113-65-3D, Bis(trifluoromethylsulfonyl)
 imide, alkali metal salts

(polymer **electrolyte** solvent for secondary batteries)

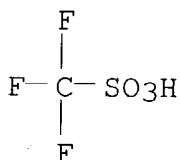
L121 ANSWER 14 OF 22 HCA COPYRIGHT 2004 ACS on STN

130:225415 Ion-conducting polymer **electrolytes**, their
 manufacture, and polymer batteries. Yagata, Hiroshi; Amano,
 Kimisuke; Sakauchi, Hiroshi; Hasegawa, Etsuo (NEC Corp., Japan).
 Jpn. Kokai Tokkyo Koho JP 11060870 A2 19990305 Heisei, 11 pp.
 (Japanese). CODEN: JKXXAF. APPLICATION: JP 1997-228459 19970825.

AB The title **electrolytes** contain (1) polymers (A) contg.
 carbonyl groups in the main chains of repeating units 1-40, (2)
 vinylidene fluoride polymers (B) 20-70, (3) ion-dissocd. group I or
 II metal salts 1-50, and (4) org. solvents, which dissoc. the metal
 salts above, 20-85 wt.%. The polymers (A) may be polyesters,
 polycarbonates, and/or polyester-polycarbonates. The metal salts
 may be M+X- [M = Li, Na, K; X = ClO4, BF4, PF6, CF3SO3, (CF3SO2)2N,
 (C2F5SO2)N, (CF3SO2)3C, (C2F5SO2)3C]. The org. solvents may be
 ethylene carbonate, propylene carbonate, di-Me carbonate, di-Et
 carbonate, Me Et carbonate, and/or γ -butyrolactone. The
electrolytes are manufd. by prepg. thin films from molten
 mixts. contg. the polymers (A) and (B), and then impregnating the

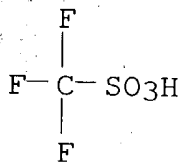
films with the org. solvent solns. contg. the metal salts. Alternatively, the process contains prepg. mixed solns. contg. the polymers (A), the polymers (B), the metal salts, the org. solvents, and volatile solvents, applying the solns. on the surface of solids, and volatilizing the volatile solvents. Polymer batteries using the electrolyte above are also claimed.

- IT 2926-27-4, Potassium trifluoromethanesulfonate
 2926-30-9, Sodium trifluoromethanesulfonate
 25684-76-8, Tetrafluoroethylene-vinylidene fluoride copolymer 33454-82-9, Lithium trifluoromethanesulfonate
 90076-65-6, Lithium bis(trifluoromethylsulfonyl)imide 90076-67-8 91742-21-1, Sodium bis(trifluoromethylsulfonyl)imide 132843-44-8
 , Lithium bis(pentafluoroethylsulfonyl)imide 152894-04-7 221203-22-1
 (ion-conducting electrolytes contg. carbonyl polymer, vinylidene fluoride polymer, metal salt, and carbonate solvent for polymer battery)
- RN 2926-27-4 HCA
 CN Methanesulfonic acid, trifluoro-, potassium salt (8CI, 9CI) (CA INDEX NAME)



● K

- RN 2926-30-9 HCA
 CN Methanesulfonic acid, trifluoro-, sodium salt (8CI, 9CI) (CA INDEX NAME)

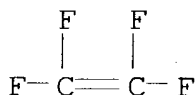


● Na

RN 25684-76-8 HCA
CN Ethene, tetrafluoro-, polymer with 1,1-difluoroethene (9CI) (CA INDEX NAME)

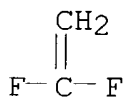
CM 1

CRN 116-14-3
CMF C2 F4

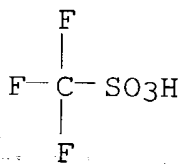


CM 2

CRN 75-38-7
CMF C2 H2 F2

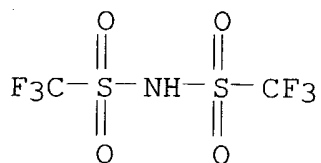


RN 33454-82-9 HCA
CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



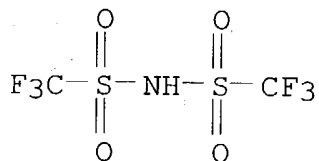
● Li

RN 90076-65-6 HCA
CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



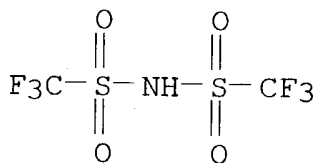
● Li

RN 90076-67-8 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-,
potassium salt (9CI) (CA INDEX NAME)

● K

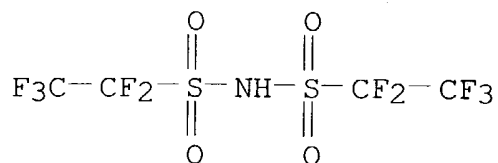
RN 91742-21-1 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-,
sodium salt (9CI) (CA INDEX NAME)

● Na

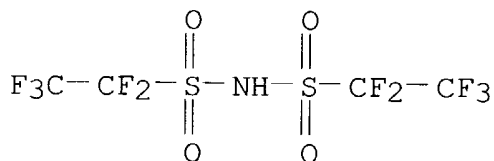
RN 132843-44-8 HCA

CN Ethanesulfonamide, 1,1,2,2,2-pentafluoro-N-
[(pentafluoroethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



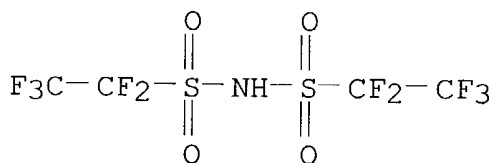
● Li

RN 152894-04-7 HCA
 CN Ethanesulfonamide, 1,1,2,2,2-pentafluoro-N-
 [(pentafluoroethyl)sulfonyl]-, sodium salt (9CI) (CA INDEX NAME)



● Na

RN 221203-22-1 HCA
 CN Ethanesulfonamide, 1,1,2,2,2-pentafluoro-N-
 [(pentafluoroethyl)sulfonyl]-, potassium salt (9CI) (CA INDEX NAME)



● K

IC ICM C08L027-16
 ICS C08K003-24; C08L069-00; H01B001-12; H01M006-18; H01M006-22;
 H01M010-40
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 38
 ST polyvinylidene fluoride battery **electrolyte**; polycarbonate

polyester battery **electrolyte**; lithium salt polymer battery **electrolyte**; sodium salt polymer battery **electrolyte**; potassium salt polymer battery **electrolyte**; carbonate solvent polymer battery **electrolyte**

- IT Polycarbonates, uses
Polycarbonates, uses
(cardo; ion-conducting **electrolytes** contg. carbonyl polymer, vinylidene fluoride polymer, metal salt, and carbonate solvent for polymer battery)
- IT Battery **electrolytes**
Polymer **electrolytes**
Secondary batteries
(ion-conducting **electrolytes** contg. carbonyl polymer, vinylidene fluoride polymer, metal salt, and carbonate solvent for polymer battery)
- IT Alkali metal salts
Alkaline earth salts
Fluoropolymers, uses
Polycarbonates, uses
Polyesters, uses
(ion-conducting **electrolytes** contg. carbonyl polymer, vinylidene fluoride polymer, metal salt, and carbonate solvent for polymer battery)
- IT Conducting polymers
(ionic; ion-conducting **electrolytes** contg. carbonyl polymer, vinylidene fluoride polymer, metal salt, and carbonate solvent for polymer battery)
- IT Polyesters, uses
Polyesters, uses
(polycarbonate-; ion-conducting **electrolytes** contg. carbonyl polymer, vinylidene fluoride polymer, metal salt, and carbonate solvent for polymer battery)
- IT Cardo polymers
Cardo polymers
(polycarbonates; ion-conducting **electrolytes** contg. carbonyl polymer, vinylidene fluoride polymer, metal salt, and carbonate solvent for polymer battery)
- IT Polycarbonates, uses
Polycarbonates, uses
(polyester-; ion-conducting **electrolytes** contg. carbonyl polymer, vinylidene fluoride polymer, metal salt, and carbonate solvent for polymer battery)
- IT Ionic conductors
(polymeric; ion-conducting **electrolytes** contg. carbonyl polymer, vinylidene fluoride polymer, metal salt, and carbonate solvent for polymer battery)
- IT 96-48-0, γ -Butyrolactone 96-49-1, Ethylene carbonate

105-58-8, Diethyl carbonate 108-32-7, Propylene carbonate
 616-38-6, Dimethyl carbonate 623-53-0, Methyl ethyl carbonate
 2926-27-4, Potassium trifluoromethanesulfonate
 2926-30-9, Sodium trifluoromethanesulfonate 7601-89-0,
 Sodium perchlorate 7778-74-7, Potassium perchlorate 7791-03-9,
 Lithium perchlorate 13755-29-8, Sodium borofluoride 14075-53-7,
 Potassium borofluoride 14283-07-9 17084-13-8, Potassium
 hexafluorophosphate 21324-39-0, Sodium hexafluorophosphate
 21324-40-3, Lithium hexafluorophosphate 24937-79-9, Polyvinylidene
 fluoride 24968-12-5 25135-52-8, Iupilon Z 200 25569-53-3,
 Poly(ethylene succinate) 25667-11-2, Poly(ethylene succinate)
 25684-76-8, Tetrafluoroethylene-vinylidene fluoride
 copolymer 26062-94-2, Poly(butylene terephthalate) 26471-16-9
 33454-82-9, Lithium trifluoromethanesulfonate
 90076-65-6, Lithium bis(trifluoromethylsulfonyl)
 imide 90076-67-8 91742-21-1, Sodium bis(
 trifluoromethylsulfonyl)imide 114395-69-6
 132404-42-3 132843-44-8, Lithium bis(
 pentafluoroethylsulfonyl)imide 152894-04-7
 156088-05-0 210406-60-3 221203-21-0 221203-22-1
 221203-23-2
 (ion-conducting **electrolytes** contg. carbonyl polymer,
 vinylidene fluoride polymer, metal salt, and carbonate solvent
 for polymer battery)

L121 ANSWER 15 OF 22 HCA COPYRIGHT 2004 ACS on STN

124:150975 **Electrolyte** peeling agents for composite layered
 polymeric battery **electrolytes**. Brochu, Fernand; Duval,
 Michel (Hydro-Quebec, Can.). Can. Pat. Appl. CA 2142561 AA
 19950924, 14 pp. (French). CODEN: CPXXEB. APPLICATION: CA
 1995-2142561 19950215. PRIORITY: US 1994-216415 19940323.

AB C5-15-aliph. or cycloaliph. hydrocarbons, esp. heptane or
 cycloheptane, are used as peeling agents for laminated
electrolytes contg. Li salts and copolymers on a
 polypropylene support with a polyethylene protective film.

IT 9002-84-0, Ptfе
 (Teflon; **electrolyte** peeling agents for composite
 layered polymeric battery **electrolytes**)

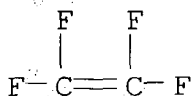
RN 9002-84-0 HCA

CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

CMF C2 F4

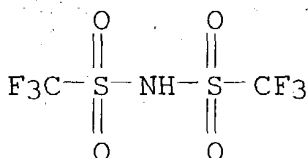


IT 90076-65-6, Lithium bis(trifluoromethanesulfonyl) imide

(electrolyte peeling agents for composite layered polymeric battery electrolytes)

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

IC ICM H01M006-02

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST battery laminated electrolyte peeling agent; heptane battery electrolyte peeling agent; cycloheptane battery electrolyte peeling agent

IT Battery electrolytes

(electrolyte peeling agents for composite layered polymeric battery electrolytes)

IT Rubber, silicone, uses

(electrolyte peeling agents for composite layered polymeric battery electrolytes)

IT Siloxanes and Silicones, uses

(polypropylene polymers; electrolyte peeling agents for composite layered polymeric battery electrolytes)

IT Glass, oxide

(plate, electrolyte peeling agents for composite layered polymeric battery electrolytes)

IT 9002-84-0, Ptfе

(Teflon; electrolyte peeling agents for composite layered polymeric battery electrolytes)

IT 7439-93-2D, Lithium, salts 9002-88-4, Polyethylene 9003-07-0, Polypropylene 9003-07-0D, Polypropylene, silicone copolymers 9010-79-1D, Ethylene-propylene copolymer, fluorinated 25038-59-9,

Mylar, uses 90076-65-6, Lithium bis(trifluoromethanesulfonyl)imide

(electrolyte peeling agents for composite layered polymeric battery electrolytes)

IT 142-82-5, Heptane, uses 291-64-5, Cycloheptane (electrolyte peeling agents for composite layered polymeric battery electrolytes)

IT 7429-90-5, Aluminum, uses (foil collector; electrolyte peeling agents for composite layered polymeric battery electrolytes)

L121 ANSWER 16 OF 22 HCA COPYRIGHT 2004 ACS on STN

123:233342 Primary or secondary batteries with electrodes comprising nanometer size particles. Exnar, Ivan; Graetzel, Michael; Randin, Jean-paul (Renata A.-G., Switz.). Eur. Pat. Appl. EP 664570 A1 19950726, 11 pp. (French). CODEN: EPXXDW. APPLICATION: EP 1995-100174 19950109. PRIORITY: FR 1994-648 19940121.

AB The electrodes are compressed ultrafine powders (e.g., of TiO₂ and graphite) as pastes or in sintered colloidal films. The electrodes are useful in Li batteries with Li intercalatable anodes and lithiated cathodes.

IT 9002-84-0, Ptfе (electrode; primary or secondary Li batteries with electrodes comprising nanometer size particles)

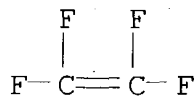
RN 9002-84-0 HCA

CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

CMF C2 F4

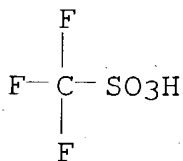


IT 33454-82-9, Lithium triflate 90076-65-6, Lithium bis(trifluoromethylsulfonyl)imide 131651-65-5

(electrolyte; primary or secondary Li batteries with electrodes comprising nanometer size particles)

RN 33454-82-9 HCA

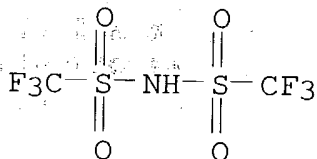
CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



● Li

RN 90076-65-6 HCA

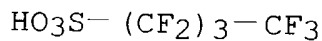
CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

RN 131651-65-5 HCA

CN 1-Butanesulfonic acid, 1,1,2,2,3,3,4,4,4-nonafluoro-, lithium salt (9CI) (CA INDEX NAME)



● Li

IC ICM H01M004-38

ICS H01M004-36; H01M004-48; H01M004-58

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

IT 7782-42-5, Graphite, uses 9002-84-0, Ptfe

(electrode; primary or secondary Li batteries with electrodes comprising nanometer size particles)

IT 7791-03-9, Lithium perchlorate 14024-11-4, Lithium

tetrachloroaluminate 14283-07-9, Lithium tetrafluoroborate

21324-40-3, Lithium hexafluorophosphate 29935-35-1, Lithium

hexafluoroarsenate 33454-82-9, Lithium triflate

90076-65-6, Lithium bis(trifluoromethylsulfonyl)

imide 131651-65-5 132404-42-3

(electrolyte; primary or secondary Li batteries with electrodes comprising nanometer size particles)

L121 ANSWER 17 OF 22 HCA COPYRIGHT 2004 ACS on STN

120:139205 Lithium secondary battery and method of manufacturing carbonaceous anode materials. Takami, Norio; Satoh, Asako; Ohsaki, Takahisa (Toshiba Corp., Japan). Eur. Pat. Appl. EP 573266 A1 19931208, 52 pp. DESIGNATED STATES: R: DE, FR, GB. (English). CODEN: EPXXDW. APPLICATION: EP 1993-304258 19930601. PRIORITY: JP 1992-140247 19920601; JP 1992-261418 19920930; JP 1993-56194 19930316; JP 1993-58565 19930318.

AB The lithium secondary battery includes a cathode housed in a case, an anode housed in the case and contg. a carbonaceous material with exothermic peak at $\geq 700^\circ$ when measured by a differential thermal anal. and an intensity ratio P101/P100 of a (101) diffraction peak P101 to a (100) diffraction peak P100 of a graphite structure, obtained by x-ray diffraction anal., of 0.7 to 2.2, and absorbs lithium ions, a separator housed in the case so as to be arranged between the pos. and neg. electrodes, and a nonaq. electrolyte contained in the case. The battery has high capacity and excellent charge-discharge efficiency, cycle life, flatness of a discharge voltage, and rapid charge-discharge cycle characteristics.

IT 9002-84-0, Ptfе 33454-82-9 90076-65-6,
Lithium bistrifluoromethylsulfonylimide

(in nonaq. secondary lithium batteries with carbon anode)

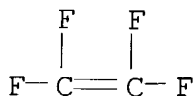
RN 9002-84-0 HCA

CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

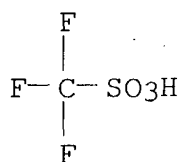
CRN 116-14-3

CMF C2 F4



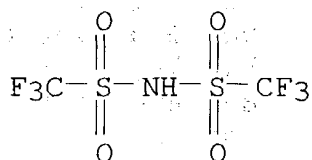
RN 33454-82-9 HCA

CN Methanesulfonic acid, trifluoro-, lithium salt (8CI, 9CI) (CA INDEX NAME)



● Li

RN 90076-65-6 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-,
lithium salt (9CI) (CA INDEX NAME)

● Li

IC ICM H01M004-58

ICS H01M010-40

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

IT 75-05-8, Acetonitrile, uses 75-52-5, Nitromethane, uses 79-20-9,

Methyl acetate 96-48-0, γ -Butyrolactone 96-49-1, Ethylene

carbonate 98-95-3, Nitrobenzene, uses 105-58-8, Diethyl

carbonate 107-21-1, Ethylene glycol, uses 108-32-7, Propylene

carbonate 108-88-3, Toluene, uses 141-78-6, Ethyl acetate, uses

616-38-6, Dimethyl carbonate 1330-20-7, Xylene, uses 7429-90-5,

Aluminum, uses 7440-02-0, Nickel, uses 7440-50-8, Copper, uses

7782-50-5, Chlorine, uses 7791-03-9, Lithium perchlorate

9002-84-0, Ptfе 9010-79-1, Ethylene-propylene copolymer

12597-68-1, Stainless steel, occurrence 14283-07-9, Lithium

borofluoride 21324-40-3 29935-35-1 **33454-82-9**

39300-70-4, Lithium nickel oxide 39457-42-6, Lithium manganese

oxide 52627-24-4, Lithium cobalt oxide **90076-65-6**,Lithium **bistrifluoromethylsulfonylimide**

(in nonaq. secondary lithium batteries with carbon anode)

L121 ANSWER 18 OF 22 HCA COPYRIGHT 2004 ACS on STN

114:184787 Preparation of **sulfonyl imides** for solid

solutions for primary or secondary generators. Armand, Michel (Centre National de la Recherche Scientifique, Fr.; Hydro-Quebec). PCT Int. Appl. WO 9011999 A1 19901018, 15 pp. DESIGNATED STATES: W: CA, JP, US; RW: AT, BE, CH, DE, DK, ES, FR, GB, IT, LU, NL, SE. (French). CODEN: PIXXD2. APPLICATION: WO 1990-FR240 19900405. PRIORITY: FR 1989-4504 19890406.

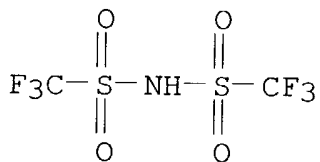
AB M[(RSO₂)₂N]_y [M = alkali metal, alk. earth metal, etc.; R = aliph. radical, alicyclic radical, etc.; y = valence of M], capable of forming **solid solns.** with **polymers** for manuf. of **solid polymeric electrolytes** for primary or secondary generators (no data), were prep'd. via, e.g., reacting an ionic nitride M₃N_y with a sulfonyl halide RSO₂X (X = Cl, F) in an aprotic polar solvent. Li₃N was autoclaved with CF₃SO₂F in THF at 50° to give 90% LiN(CF₃SO₂)₂ (I). A thin polymeric film was obtained by reaction of I with poly(ethylene oxide) in MeCN.

IT 82113-65-3P 90076-65-6P 119229-99-1P

(prepn. of, for solid solns.)

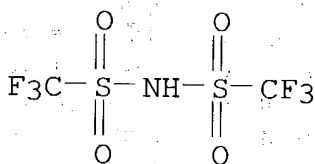
RN 82113-65-3 HCA

CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-(9CI) (CA INDEX NAME)



RN 90076-65-6 HCA

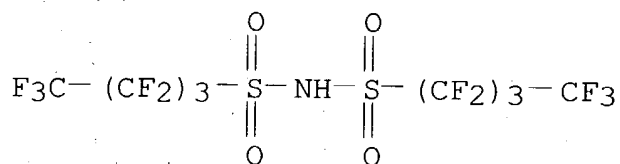
CN Methanesulfonamide, 1,1,1-trifluoro-N-[(trifluoromethyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)



● Li

RN 119229-99-1 HCA

CN 1-Butanesulfonamide, 1,1,2,2,3,3,4,4,4-nonafluoro-N-[(nonafluorobutyl)sulfonyl]-, lithium salt (9CI) (CA INDEX NAME)

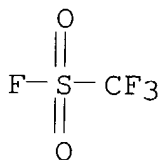


● Li

IT 335-05-7, Trifluoromethanesulfonyl fluoride 375-72-4
 , Perfluorobutanesulfonyl fluoride
 (reaction of, with nitride in prepn. of sulfonyl
 imides)

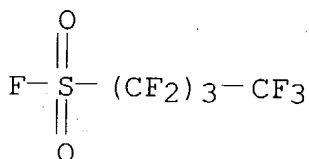
RN 335-05-7 HCA

CN Methanesulfonyl fluoride, trifluoro- (6CI, 8CI, 9CI) (CA INDEX
 NAME)



RN 375-72-4 HCA

CN 1-Butanesulfonyl fluoride, 1,1,2,2,3,3,4,4,4-nonafluoro- (8CI, 9CI)
 (CA INDEX NAME)



IT 9002-84-0

(solid electrolytes contg. polyethylene oxide and Li
 trifluoromethylsulfonyl imide, for primary and
 secondary generators)

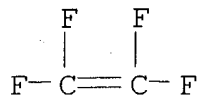
RN 9002-84-0 HCA

CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

CMF C2 F4



- IC ICM C07C311-48
 CC 23-4 (Aliphatic Compounds)
 Section cross-reference(s): 52
 ST **sulfonyl imide** prepn solid soln; generator solid
electrolyte sulfonyl imide
 IT Electric generators
 (solid **electrolytes** for, **sulfonyl**
imides for)
 IT Solid solutions
 (sulfonyl imides for)
 IT **Electrolytes**
 (solid, solid solns. for, **sulfonyl imides**
 for)
 IT 82113-65-3P 90076-65-6P 119229-99-1P
 133395-16-1P 133395-17-2P
 (prepn. of, for solid solns.)
 IT 124-63-0, Methanesulfonyl chloride 335-05-7,
 Trifluoromethanesulfonyl fluoride 375-72-4,
 Perfluorobutanesulfonyl fluoride
 (reaction of, with nitride in prepn. of **sulfonyl**
imides)
 IT 56127-34-5, Magnesium nitride
 (reaction of, with trifluoromethanesulfonyl halide in prepn. of
sulfonyl imide)
 IT 26134-62-3, Lithium nitride
 (reaction of, with trifluoromethanesulfonyl halides in prepn. of
sulfonyl imides)
 IT 9002-84-0
 (solid **electrolytes** contg. polyethylene oxide and Li
trifluoromethylsulfonyl imide, for primary and
 secondary generators)
 IT 25322-68-3
 (solid **electrolytes** contg. polytetrafluoroethylene and
 Li **trifluoromethylsulfonyl imide**, for primary
 and secondary generators)

L121 ANSWER 19 OF 22 HCA COPYRIGHT 2004 ACS on STN

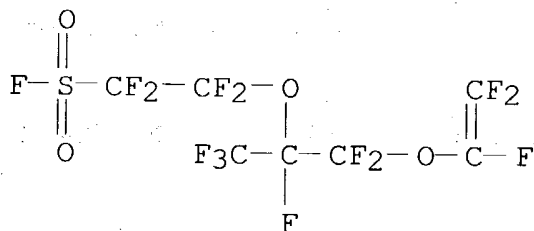
102:205106 Anion exchangers from perfluoropolymer films. (Toyo Soda Mfg.
 Co., Ltd., Japan; Sagami Chemical Research Center). Jpn. Kokai
 Tokkyo Koho JP 60004537 A2 19850111 Showa, 6 pp. (Japanese).
 CODEN: JKXXAF. APPLICATION: JP 1983-111864 19830623.

- AB An anion-exchange membrane is prepd. by grafting a vinyl monomer contg. a tertiary ammonium group precursor on a perfluoro polymer membrane. Thus, a copolymer film (thickness 110 μ) from CF₂:CF₂ and CF₂:CFOCF₂CF(CF₃)O(CF₂)₂CO₂Me was hydrolyzed, **treated** with **dimethylamine**, hydrogenated, and **treated** with MeI to give a film contg. quaternary ammonium salts (anion-exchange capacity 0.82 mequiv./g, resistance 3.3 Ω -cm² in 0.5 N aq. NaCl at 25° and transport no. 0.88 between 0.5 N and 2.0 N aq. NaCl). The film was then immersed in a soln. comprising chloromethylstyrene 80, divinylbenzene 20, Bz₂O₂ 2, and MeOH 20 parts for 24 h at 25°, heat-treated at 175-80° for 16 h, and treated with a mixt. of 10 parts 30% Me₃N and 3 parts MeOH for 10 h to give a film exhibiting resistance 1.8 Ω -cm² and transport no. 0.87.
- IT **26654-97-7D**, quaternized, grafted with vinylpyridine, quaternized **71538-47-1D**, quaternized, grafted with chloromethylstyrene or amine-contg. styrenes, quaternized (anion-exchange membranes, with low elec. resistance)
- RN 26654-97-7 HCA
- CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

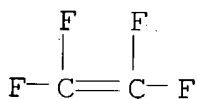
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



RN 71538-47-1 HCA
CN Nafion 114 (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
IC ICM C08J005-22
ICS B01J047-12
CC 38-3 (Plastics Fabrication and Uses)
IT 100-43-6D, polymers with quaternized perfluoropolymers, quaternized
26654-97-7D, quaternized, grafted with vinylpyridine,
quaternized 30027-91-9D, polymers with quaternized
perfluoropolymers, graft, quaternized 30030-25-2D, polymers with
quaternized perfluoropolymers, quaternized 63863-44-5D,
quaternized, grafted with chloromethylstyrene and divinylbenzene,
quaternized 71538-47-1D, quaternized, grafted with
chloromethylstyrene or amine-contg. styrenes, quaternized
(anion-exchange membranes, with low elec. resistance)

L121 ANSWER 20 OF 22 HCA COPYRIGHT 2004 ACS on STN
98:188115 Electrolytic cell ion-exchange membranes. Ezzell, Bobby R.;
Burney, Harry S., Jr.; Sorenson, Marius W. (Dow Chemical Co., USA).
U.S. US 4376030 A 19830308, 6 pp. Cont.-in-part of U.S. Ser. No.
70,183. (English). CODEN: USXXAM. APPLICATION: US 1981-240349
19810304. PRIORITY: US 1979-70183 19790827.

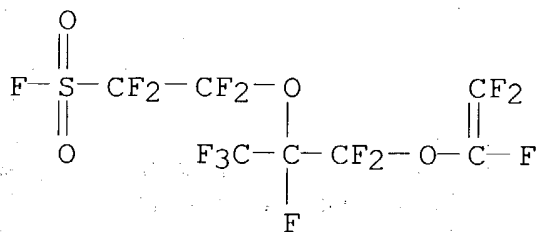
AB The title membranes are **treated** with **amines** to
provide dimensional stability and other improvements. Thus, the
acid form of a membrane comprising hydrolyzed copolymer of
tetrafluoroethylene and perfluoro(3,6-dioxo-4-methyl-7-
octenesulfonyl fluoride) of equiv. wts. 1100 and 1500 laminated
together and com. available as **Nafion** 324 was
treated with 30% **triethanolamine** for different
periods of time and at different temps. The effects of this
treatment on the phys. properties e.g. expansion are given.

IT 26654-97-7 67053-88-7
(membranes, ion-exchanging, for brine electrolysis, **amine**
treatment of)

RN 26654-97-7 HCA
CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl
]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with
tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



RN 67053-88-7 HCA

CN Nafion 324 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC C25B013-08

NCL 204296000

CC 72-9 (Electrochemistry)

Section cross-reference(s): 38, 49

ST ion exchange membrane **amine treatment**

IT Brines

(electrolysis of, fluoropolymer ion-exchange membranes for, **amine treatment** of)

IT Electrolytic cells

(for brine electrolysis, fluoropolymer membranes in, **amine treatment** of)

IT Fluoropolymers

(membranes, ion-exchanging, for brine electrolysis, **amine treatment** of)

IT Ion exchangers

(membranes, fluoropolymers, **amine treatment** of, for electrolytic cell for brine electrolysis)

IT 26654-97-7 67053-88-7

(membranes, ion-exchanging, for brine electrolysis, **amine treatment** of)

L121 ANSWER 21 OF 22 HCA COPYRIGHT 2004 ACS on STN

97:199292 Stabilizing the dimensions of fluoropolymer membranes containing sulfonate and/or carboxylate functional groups for use in

electrolytic cells. Ezzell, Bobby Ray; Burney, Harry Stevens, Jr.; Sorenson, Marius Walter (Dow Chemical Co., USA). Eur. Pat. Appl. EP 59522 A1 19820908, 25 pp. DESIGNATED STATES: R: BE, DE, FR, GB, IT, NL. (English). CODEN: EPXXDW. APPLICATION: EP 1982-200274 19820303. PRIORITY: US 1981-240349 19810304.

AB Ion-exchange membranes for electrolytic cells comprising fluoropolymers having pendant carboxylic or sulfonic acid functional groups are **treated** with **amines** to provide dimensional stability, and the easily dissociable amine salts are leached out by a cell electrolyte allowing the acid groups to function as ion exchange sites in the membrane during cell operation. Thus, a **Nafion** 324 [perfluoro(3,6-dioxo-4-methyl-7-octenesulfonyl fluoride)-tetrafluoroethylene copolymer] [26654-97-7] membrane was treated 30 min at 23° with a 30% aq. soln. of triethanolamine (I) [102-71-6] to give a membrane with 6.3% transverse expansion and 5.9% machine expansion during contact with I and 3.3% transverse expansion and 3.3% machine expansion after drying 1 day.

IT 26654-97-7 67053-88-7

(membranes, ion-exchange, amines as dimensional stabilizers for)

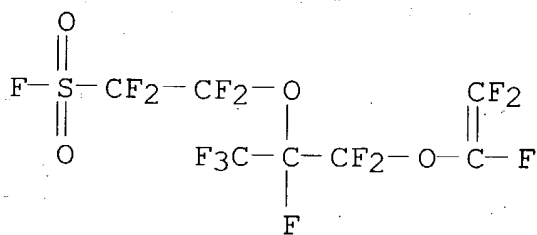
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

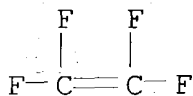
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



RN 67053-88-7 HCA

CN Nafion 324 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC C08J005-22; C25B013-00; C25B013-08

CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 72

IT 26654-97-7 67053-88-7

(membranes, ion-exchange, amines as dimensional stabilizers for)

L121 ANSWER 22 OF 22 HCA COPYRIGHT 2004 ACS on STN

95:99050 Manufacture of ion-exchange membranes. (Kanegafuchi Chemical Industry Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 56057833

19810520 Showa, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1979-133346 19791015.

AB Membranes of fluoropolymers with $\text{CH}_2\text{SO}_2\text{Cl}$ substituents in pendant groups were treated with an amine and brominated at $\leq 100^\circ$ to give $\text{CF}_2\text{SO}_2\text{Br}$ group-contg. membranes for electrolytic cells. For example, a 0.1 mm hydrolyzed tetrafluoroethylene-perfluoro-3,6-dioxo-4-methyl-7-octenesulfonyl fluoride copolymer membrane was treated with 1:1 $\text{PCl}_5\text{-POCl}_3$ under reflux for 24 h to form sulfonyl chloride groups, washed with CCl_4 , dried, immersed in ethylenediamine for 24 h, washed with MeOH, and heated with Br satd. in CHCl_3 at 5° for 5 h to give a sulfonyl bromide group-contg. membrane.

IT 26654-97-7D, hydrolyzed, chlorinated, aminated, brominated
71538-47-1D, chlorinated, aminated, brominated
(ion-exchange membranes, for electrolytic cells)

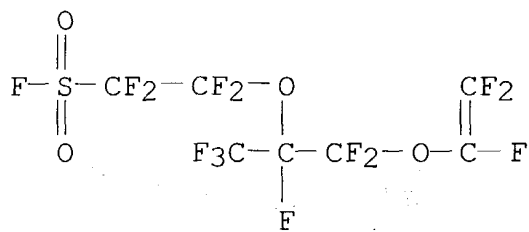
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

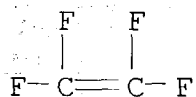
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



RN 71538-47-1 HCA

CN Nafion 114 (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC C08J005-22; B01J047-12; C08J007-12

CC 37-3 (Plastics Fabrication and Uses)

IT 26654-97-7D, hydrolyzed, chlorinated, aminated, brominated

71538-47-1D, chlorinated, aminated, brominated

(ion-exchange membranes, for electrolytic cells)

=> d 1122 1-26 ti

L122 ANSWER 1 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Ion transporting composite membranes. II. Ion transport mechanism in

Nafion-impregnated GORE-TEX membranes

L122 ANSWER 2 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Preparation of triacetone amine and other oxopiperidines by
 cyclocondensation of ketones with ammonia using
 perfluorinated sulfonic acid catalysts

L122 ANSWER 3 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Linear- and nonlinear-optical properties of semiconductor clusters

L122 ANSWER 4 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI RF-plasma treatment of Nafion film electrodes

L122 ANSWER 5 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Gas sensors

L122 ANSWER 6 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Enhanced oxygen evolution through electrochemical water oxidation mediated by polynuclear complexes embedded in a polymer film

L122 ANSWER 7 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Immobilized photosynthetic systems for the production of ammonia and photocurrents

L122 ANSWER 8 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Permeability of RF-plasma treated Nafion films on glassy carbon electrodes

L122 ANSWER 9 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Reaction entropies and acid-base behavior of transition-metal complexes in recast Nafion films

L122 ANSWER 10 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Method of making a coating and a permselective membrane, ionic polymer therefor, and products thereof

L122 ANSWER 11 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Perfluorosulfonate ionomer film coated electrodes as electrochemical sensors: fundamental investigations

L122 ANSWER 12 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Mononuclear ruthenium-ammine complexes as catalysts for water oxidation

L122 ANSWER 13 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Probing polymer-induced reactivity effects in modified electrode/catalyst systems

L122 ANSWER 14 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Kinetic studies of ligand substitution rates for the Ru(NH₃)₅(H₂O)₂⁺ ion in Nafion films

L122 ANSWER 15 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Pollutant sampler for measurements of atmospheric acidic dry deposition

L122 ANSWER 16 OF 26 HCA COPYRIGHT 2004 ACS on STN

TI Reaction entropy measurements for transition-metal ions bound to Nafion-coated electrode surfaces

L122 ANSWER 17 OF 26 HCA COPYRIGHT 2004 ACS on STN

- TI Probing polymer effects on chemical reactivity: ligand substitution kinetics of $\text{Ru}(\text{NH}_3)_5(\text{H}_2\text{O})_2^+$ in **Nafion** films
- L122 ANSWER 18 OF 26 HCA COPYRIGHT 2004 ACS on STN
- TI Charge-transport rates in **Nafion** coatings on electrodes. Surprisingly disparate diffusion coefficients for a single molecule containing two electroactive centers
- L122 ANSWER 19 OF 26 HCA COPYRIGHT 2004 ACS on STN
- TI Electrocatalysis at redox polymer electrodes with separation of the catalytic and charge propagation roles. Reduction of dioxygen to hydrogen peroxide as catalyzed by cobalt(II) tetrakis(4-N-methylpyridyl)porphyrin
- L122 ANSWER 20 OF 26 HCA COPYRIGHT 2004 ACS on STN
- TI Electrochemical behavior of cationic complexes incorporated in clay coatings on graphite electrodes
- L122 ANSWER 21 OF 26 HCA COPYRIGHT 2004 ACS on STN
- TI Enhancement of charge-transport rates by redox cross-reactions between reactants incorporated in **Nafion** coatings
- L122 ANSWER 22 OF 26 HCA COPYRIGHT 2004 ACS on STN
- TI Redox mediation of dioxygen reduction within **Nafion** electrode coatings containing colloidal platinum as catalyst
- L122 ANSWER 23 OF 26 HCA COPYRIGHT 2004 ACS on STN
- TI Sulfur dioxide sensor
- L122 ANSWER 24 OF 26 HCA COPYRIGHT 2004 ACS on STN
- TI Process and apparatus for continuously coating a solid electrolyte with a catalytically active metal
- L122 ANSWER 25 OF 26 HCA COPYRIGHT 2004 ACS on STN
- TI Electron hopping vs. molecular diffusion as charge transfer mechanisms in redox polymer films
- L122 ANSWER 26 OF 26 HCA COPYRIGHT 2004 ACS on STN
- TI Electrodeposition of metals of Groups Ib and VIII
- => d l126 1,11 cbib abs hitstr hitind
- L126 ANSWER 1 OF 26 HCA COPYRIGHT 2004 ACS on STN
- 112:165832 Ion transporting composite membranes. II. Ion transport mechanism in **Nafion**-impregnated GORE-TEX membranes. Liu, Chao; Martin, Charles R. (Dep. Chem., Texas A and M Univ., College Station, TX, 77843, USA). Journal of the Electrochemical Society,

137(2), 510-15 (English) 1990. CODEN: JESOAN. ISSN: 0013-4651.

AB The mechanism of Ru(NH₃)₆³⁺ transport in NIGT membranes is examd. The dependences of the diffusion coeffs. on the concn. of the electroactive species and on the wt. fraction of **Nafion** in NIGT membranes were detd. The apparent diffusion coeffs. for Ru(NH₃)₆³⁺ and Ru(NH₃)₆²⁺ are directly proportional to the inverse wt. fraction of **Nafion** in the NIGT membrane. The diffusion of the ions apparently is coupled between the ions residing in the soln. phase and the ions electrostatically bound to SO₃⁻ sites in the **Nafion** phase. By controlling the wt. fraction of the **Nafion** in the NIGT membranes, one can vary Ru(NH₃)₆³⁺ and Ru(NH₃)₆²⁺ diffusion coeffs. from 3 + 10⁻⁸ cm²/s to 3 + 10⁻⁷ cm²/s.

IT 31175-20-9

(diffusion coeffs. of ruthenium ammine complexes in GORE-TEX membranes impregnated with **Nafion** 117)

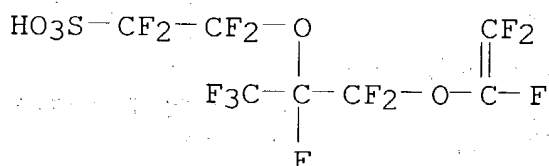
RN 31175-20-9 HCA

CN Ethanesulfonic acid, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 29311-67-9

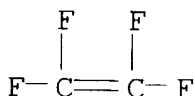
CMF C7 H F13 O5 S



CM 2

CRN 116-14-3

CMF C2 F4



CC 66-4 (Surface Chemistry and Colloids)

Section cross-reference(s): 38, 68, 72

ST membrane diffusion ruthenium ammine complex; **Nafion**

composite membrane ion transport; GORE TEX composite membrane
Nafion; sulfo group binding ruthenium complex

IT Diffusion

(of ruthenium ammine complexes, in GORE-TEX membranes impregnated
with **Nafion**)

IT 31175-20-9

(diffusion coeffs. of ruthenium ammine complexes in GORE-TEX
membranes impregnated with **Nafion** 117)

IT 18943-33-4, Hexaammine ruthenium(3+) 19052-44-9, Hexaammine
ruthenium(2+)

(diffusion coeffs. of, in GORE-TEX membranes impregnated with
Nafion)

IT 9002-84-0, GORE-TEX

(membranes, impregnated with **Nafion**, diffusion coeffs.
of ruthenium ammine complexes in)

L126 ANSWER 11 OF 26 HCA COPYRIGHT 2004 ACS on STN

107:32203 Perfluorosulfonate ionomer film coated electrodes as
electrochemical sensors: fundamental investigations. Whiteley,
Lisa D.; Martin, Charles R. (Dep. Chem., Texas A and M Univ.,
College Station, TX, 77843, USA). Analytical Chemistry, 59(14),
1746-51 (English) 1987. CODEN: ANCHAM. ISSN: 0003-2700.

AB Response characteristics of electrochem. sensors prepd. by coating
glassy C electrode surfaces with perfluorosulfonate ionomer (PFSI)
films were studied. The effects of various exptl. parameters on
sensitivity, detection limit, and linear response range of the
PFSI-coated electrodes were examd. The exptl. parameters
investigated included film thickness, duration of exposure of the
film to the analyte [Ru(NH₃)₆³⁺] soln., and electrochem.
detection method. PFSI-modified electrodes can be extremely
sensitive electrochem. sensors. Differential pulse detection at the
PFSI-film coated electrode provided the lowest detection limit
(10⁻⁹M). Methods of purging the analyte cation from the PFSI film
were also tested. **Nafion** was used as PFSI.

IT 31175-20-9, **Nafion**

(electrodes coated with, sensing properties of)

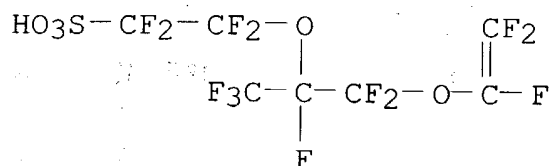
RN 31175-20-9 HCA

CN Ethanesulfonic acid, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-
1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with
tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 29311-67-9

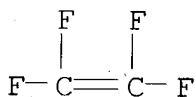
CMF C7 H F13 O5 S



CM 2

CRN 116-14-3

CMF C2 F4



- CC 79-2 (Inorganic Analytical Chemistry)
 IT Electrodes
 (hexaammineruthenium-sensitive, **Nafion**-film-coated)
 IT 18943-33-4, Hexaammineruthenium(3+)
 (detn. of, **Nafion**-film-coated electrodes for)
 IT 31175-20-9, **Nafion**
 (electrodes coated with, sensing properties of)

=> d 1127 1-44 ti

- L127 ANSWER 1 OF 44 HCA COPYRIGHT 2004 ACS on STN
 TI Galvanodynamic study of the electrochemical switching effect in
 perfluorinated cation-exchange membranes **modified** by
ethylenediamine
- L127 ANSWER 2 OF 44 HCA COPYRIGHT 2004 ACS on STN
 TI Polytetrafluoroethylene granular powders and their manufacture
- L127 ANSWER 3 OF 44 HCA COPYRIGHT 2004 ACS on STN
 TI **Ammonia** purification method
- L127 ANSWER 4 OF 44 HCA COPYRIGHT 2004 ACS on STN
 TI Electroless deposition of platinum on proton-conductive
 perfluorinated membranes **modified** with ethylene
diamine
- L127 ANSWER 5 OF 44 HCA COPYRIGHT 2004 ACS on STN
 TI Gas and gaseous precursor filled microspheres as topical and

subcutaneous delivery vehicles

L127 ANSWER 6 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Mass transfer of hydrogen fluoride through a perfluorinated membrane containing sulfonamide groups

L127 ANSWER 7 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Process for the preparation of spherically shaped microcomposites for use as isomerization or alkylation catalysts

L127 ANSWER 8 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Fluorine-containing resin molded articles with antistatic property

L127 ANSWER 9 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Free radical generating initiators for making fluoropolymers

L127 ANSWER 10 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Fluorocopolymer gas-separation membranes

L127 ANSWER 11 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Selective electrodialysis of hydrogen ions

L127 ANSWER 12 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Specifics of highly selective ammonia transport through gas-separating membranes based on perfluorinated copolymer in the form of hollow fibers

L127 ANSWER 13 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Optical transient bleaching of quantum-confined cadmium sulfide clusters: the effects of surface-trapped electron-hole pairs

L127 ANSWER 14 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Sulfonamide-containing fluoropolymer anion-exchange membranes

L127 ANSWER 15 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Manufacture of alkali-resistant anion-exchange membranes

L127 ANSWER 16 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Separator membrane for redox-flow battery

L127 ANSWER 17 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Fluorocarbon anion exchangers

L127 ANSWER 18 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Iodinated fluoropolymers

L127 ANSWER 19 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Porous diaphragm for electrolytic cells

L127 ANSWER 20 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Polyfluoroallyloxy compounds and copolymers therefrom

L127 ANSWER 21 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Polyfluoroallyloxy compounds and copolymers from them

L127 ANSWER 22 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Polyfluoroallyloxy compounds and copolymers from them

L127 ANSWER 23 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Cation-exchange membranes

L127 ANSWER 24 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Cation exchange membrane by treatment of fluorinated polymer containing sulfonyl halide groups with amine and vinyl monomer

L127 ANSWER 25 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Cation-exchange membrane

L127 ANSWER 26 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Cation-exchange membranes from fluoropolymers

L127 ANSWER 27 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Improving current efficiency of cation-exchange membranes

L127 ANSWER 28 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Improving current efficiency of cation-exchange membranes

L127 ANSWER 29 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Improvement of cation exchange membrane

L127 ANSWER 30 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Fluorocarbon cation-exchange membrane

L127 ANSWER 31 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Cation exchange membranes

L127 ANSWER 32 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Fluorocarbon cation-exchange membrane

L127 ANSWER 33 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Cation-exchange membranes

L127 ANSWER 34 OF 44 HCA COPYRIGHT 2004 ACS on STN
TI Cathode structure for use in electrolysis

L127 ANSWER 35 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Treatment of cation-exchanger

L127 ANSWER 36 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Polyfluorocarbon-base cation exchange membranes for brine electrolysis cells

L127 ANSWER 37 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Process for producing halogen and metal hydroxides with cation exchange membranes of improved permselectivity

L127 ANSWER 38 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Electrolysis cell using cation exchange membranes of improved permselectivity

L127 ANSWER 39 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Cation exchanger membrane, used particularly for alkali metal chloride electrolysis

L127 ANSWER 40 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Membrane electrolytic cell, especially for alkali chloride electrolysis

L127 ANSWER 41 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Laminates of support material and fluorinated polymer containing pendant side chains containing sulfonyl groups

L127 ANSWER 42 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI N-Monosubstituted sulfonamido groups-containing, fluorine-containing ion exchanging polymers

L127 ANSWER 43 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Tetrafluoroethylene copolymer ion exchanger membrane

L127 ANSWER 44 OF 44 HCA COPYRIGHT 2004 ACS on STN

TI Halogenated organic compounds

=> d 1127 1,4,15,16,17,18,24,36,38,41,42 cbib abs hitstr hitind

L127 ANSWER 1 OF 44 HCA COPYRIGHT 2004 ACS on STN

136:44489 Galvanodynamic study of the electrochemical switching effect in perfluorinated cation-exchange membranes **modified by ethylenediamine**. Bessarabov, D. G.; Michaels, W. C.; Popkov, Y. M. (Department of Chemistry, University of Stellenbosch, Matieland, 7602, S. Afr.). Journal of Membrane Science, 194(1), 81-90 (English) **2001**. CODEN: JMESDO. ISSN: 0376-7388. Publisher: Elsevier Science B.V..

AB Perfluorinated sulfonyl-fluoride cation-exchange flat-sheet

membranes were **treated** with ethylene **diamine** to investigate the influence of EDA-surface-treatment on the process of electrochem. "switching" in such membranes. The galvanodynamic method was used to obtain i-V cyclic curves of the membranes. Electroless chem. deposition of Pt particles on modified membranes was achieved using the Takenaka-Torikai method. Galvanodynamic i-V cyclic curves of the plain and platinum-contg. aminated membranes were compared. Chem. modification of the membrane surface and membrane structure was investigated by means of elec. cond. measurements and IR-spectroscopy. Exptl. results indicated that the "switching" phenomenon is more likely to occur due to a pH change in the electrolyte resulting in the formation of addnl. fixed-charged groups in the aminated layers of the membranes rather than due to heterolytic dissocn. of water according to the second Wien effect.

IT 26654-97-7

(cation-exchange membranes modified by ethylenediamine)

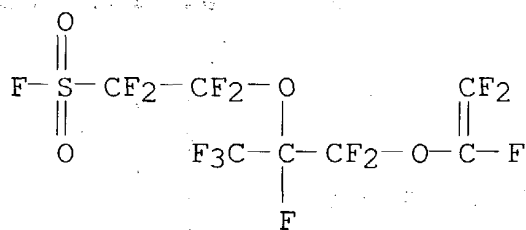
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

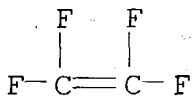
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



CC 72-2 (Electrochemistry)

Section cross-reference(s): 38, 56, 73, 76

- IT Membranes, nonbiological
(bipolar; galvanodynamic study of electrochem. switching effect in perfluorinated cation-exchange membranes **modified by ethylenediamine**)
- IT pH
(effect on elec. cond. of perfluorinated cation-exchange membranes **modified by ethylenediamine**)
- IT Electric switching
(galvanodynamic study of electrochem. switching effect in perfluorinated cation-exchange membranes **modified by ethylenediamine**)
- IT IR spectra
(of hydrolyzed perfluorinated cation-exchange membranes **modified by ethylenediamine** in HCl and NaOH solns.)
- IT Electric conductivity
(of perfluoro-3,6-dioxa-5-methyl-1-octene-8-sulfonyl fluoride copolymer with tetrafluoroethylene cation-exchange membranes **modified by ethylenediamine**)
- IT Hydrolysis
(of perfluoro-3,6-dioxa-5-methyl-1-octene-8-sulfonyl fluoride copolymer with tetrafluoroethylene cation-exchange membranes **modified by ethylenediamine** in NaOH soln.)
- IT Cyclic voltammetry
(of perfluoro-3,6-dioxa-5-methyl-1-octene-8-sulfonyl fluoride copolymer with tetrafluoroethylene cation-exchange membranes **modified by ethylenediamine** with and without embedded Pt particles)
- IT Cation exchange membranes
(perfluorinated; galvanodynamic study of electrochem. switching effect in perfluorinated cation-exchange membranes **modified by ethylenediamine**)
- IT 7647-01-0, Hydrochloric acid, uses
(IR spectra of hydrolyzed perfluorinated cation-exchange membranes **modified by ethylenediamine** in HCl and NaOH solns.)
- IT 26654-97-7
(cation-exchange membranes **modified by ethylenediamine**)
- IT 1310-73-2, Sodium hydroxide, reactions
(hydrolysis of perfluoro-3,6-dioxa-5-methyl-1-octene-8-sulfonyl fluoride copolymer with tetrafluoroethylene cation-exchange membranes **modified by ethylenediamine** in NaOH soln.)

perfluorinated membranes **modified** with ethylene diamine. Bessarabov, D. G.; Michaels, W.; Vermeulen, J. P. (Department of Chemistry, University of Stellenbosch, Matieland, 7602, S. Afr.). Ionics, 5(1 & 2), 52-58 (English) 1999. CODEN: IONIFA. ISSN: 0947-7047. Publisher: Institute for Ionics.

AB Perfluorinated, non-hydrolyzed, carbon-chain copolymer flat-sheet membranes were **treated** with ethylene **diamine** to investigate the influence of the treatment on the process of electroless Pt deposition on the membranes. The elec. resistance of the modified membranes was also measured to det. the degree of modification of the membranes. Pt-contg. membranes were characterized by using SEM to compare the profile of the Pt deposition on Pt-contg. membranes that were not modified. Dielec. anal. was used to investigate the dipole and ion mobility of hydrolyzed EDA-modified membranes.

IT 26654-97-7, Perfluoro-3,6-dioxo-5-methyl-1-octene-8-sulfonyl fluoride tetrafluoroethylene copolymer (electroless deposition of platinum on proton-conductive perfluorinated membranes **modified** with ethylene **diamine**)

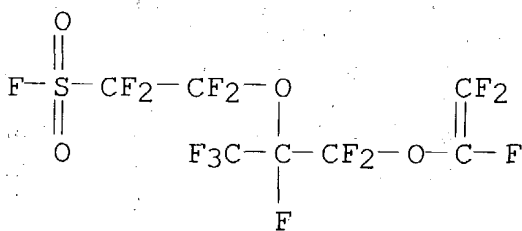
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

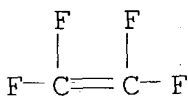
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



CC 56-6 (Nonferrous Metals and Alloys)

Section cross-reference(s): 38

IT Membranes, nonbiological

(electroless deposition of platinum on proton-conductive perfluorinated membranes **modified** with ethylene diamine)

IT Coating process

(electroless; electroless deposition of platinum on proton-conductive perfluorinated membranes **modified** with ethylene diamine)

IT 60-00-4, Edta, processes 7440-06-4, Platinum, processes

26654-97-7, Perfluoro-3,6-dioxo-5-methyl-1-octene-8-sulfonyl fluoride tetrafluoroethylene copolymer

(electroless deposition of platinum on proton-conductive perfluorinated membranes **modified** with ethylene diamine)

L127 ANSWER 15 OF 44 HCA COPYRIGHT 2004 ACS on STN

109:171800 Manufacture of alkali-resistant anion-exchange membranes.

Kiyota, Toru; Nagasawa, Yuji (Tosoh Corp., Japan). Jpn. Kokai

Tokkyo Koho JP 63068640 A2 **19880328** Showa, 5 pp.

(Japanese). CODEN: JKXXAF. APPLICATION: JP 1986-211486 19860910.

AB Title membranes are prepd. by treating films based on copolymers of C₂F₄ and CF₂:CF[[O(CF₂CFXO)]_lm(CF₂)_nSO₂F] (I, X = F, CF₃; l = 0-5; m = 0, 1; n = 1-5) (C₂F₄-I ratio 2-16) with H₂N(CH₂)_rNR₁R₂ (R₁-2 = C₁-5 alkyl; r = 2-7), followed by alkali hydroxide, and then with alkyl iodides. Thus, a 125-μ film of 1:7.6 C₂F₄-CF₂:CFOCF₂CF(CF₃)OCF₂CF₂SO₂F copolymer was soaked in Me₂N(CH₂)₃NH₂ at 40° for 50 h, washed, soaked in NaOH/MeOH at 50° for 30 h, washed, dried, treated with EtI in DMF at 60° for 7 days, washed by MeOH, and soaked in LiCl/MeOH at 50° for 24 h to give a film with resistance 3.8 Ω-cm² in 0.5 N NaCl and 0.9 Ω-cm² in 1 N NaOH after soaking in aq. NaOH for 10 days, vs., 5.2 and 30, resp., for the film prepd. without NaOH/MeOH treatment.

IT **26654-97-7D**, reaction products with dialkylaminoalkylamines, quaternized

(anion-exchange membranes, manuf. of alkali-resistant)

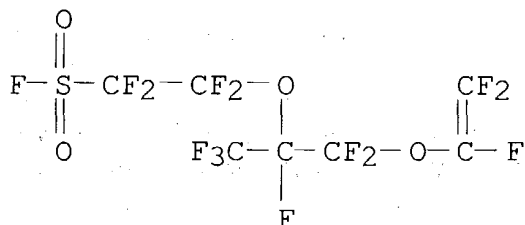
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

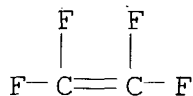
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



IC ICM C08J005-22

ICS B01D013-02

CC 38-3 (Plastics Fabrication and Uses)

Section cross-reference(s): 47

ST anion exchange membrane alkali resistance; fluoropolymer anion exchange membrane; tetrafluoroethylene copolymer anion exchange membrane; perfluoroethenylsulfonfyl fluoride copolymer anion exchanger; quaternary ammonium contg fluoropolymer; **methyaminoethylamine modified** fluoropolymer quaternized

IT Anion exchangers

(membranes, fluoropolymers, quaternized

dialkylaminoalkylamine-modified sulfonyl

fluoride-contg., alkali-resistant)

IT 108-00-9D, reaction products with fluorosulfonyl-contg.

fluoropolymers, quaternized 109-55-7D, reaction products with

fluorosulfonyl-contg. fluoropolymers, quaternized

26654-97-7D, reaction products with dialkylaminoalkylamines,

quaternized

(anion-exchange membranes, manuf. of alkali-resistant)

L127 ANSWER 16 OF 44 HCA COPYRIGHT 2004 ACS on STN

109:113458 Separator membrane for redox-flow battery. Yamamoto,

Takahisa; Kagiya, Yasuhiro (Tokuyama Soda Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 63062157 A2 **19880318** Showa, 6 pp.

(Japanese). CODEN: JKXXAF. APPLICATION: JP 1986-202639 19860830.

AB Cation-exchanger membrane is surface-modified with a thin layer of an alkylamine for use as the title membrane. Thus, a mixt. of styrene 10, chloromethylstyrene 2, acrylonitrile 2, dioctyl phthalate 1, PVC powder 1, and Bz202 0.2 parts was polymd. on a PVC cloth and successively immersed in a HSO₃Cl-H₂SO₄ mixt., in 5% soln. of dioctylamine in (iso-Pr)₂O, and in 2N aq. NaOH to obtain a separator membrane. A Cr/Fe redox-flow battery using this membrane had 82% voltage efficiency and 95% coulombic efficiency, vs. 63% and 81%, resp., for a battery using a membrane not **modified** with **dioctylamine**.

IT **26654-97-7D**, hydrolyzed and sulfonated and surface **modified with alkylamine**
(separators, for redox-flow batteries)

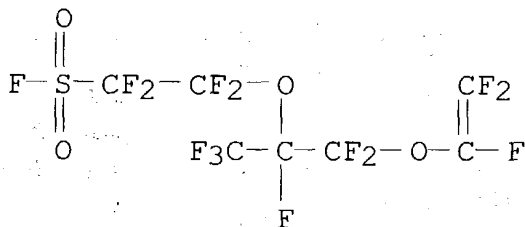
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

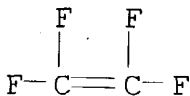
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



IT **109-73-9**, Butylamine, uses and miscellaneous
(surface **modification** with, of cation-exchanger

membranes, for chromium-iron redox-flow battery separators)

RN 109-73-9 HCA

CN 1-Butanamine (9CI) (CA INDEX NAME)

$\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{NH}_2$

IC ICM H01M008-02

ICS H01M008-18

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 38

ST battery redox flow ion exchanger separator; **dioctylamine**
modified ion exchanger separator

IT Ion exchangers

(cationic, **alkylamine-modified**, as separators
of redox-flow batteries)

IT Batteries, secondary

(redox-flow, separators, **alkylamine-modified**
cationic membrane for)

IT 9003-70-7D, Divinylbenzene-styrene copolymer, sulfonated and surface
modified with **alkylamine** 26654-97-7D,
hydrolyzed and sulfonated and surface **modified** with
alkylamine 52655-82-0D, sulfonated and surface
modified with **alkylamine** 87315-54-6D,
Bromomethylstyrene-divinylbenzene-maleic anhydride-styrene
copolymer, sulfonated and surface **modified** with
alkylamine

(separators, for redox-flow batteries)

IT 109-73-9, Butylamine, uses and miscellaneous 124-09-4,
Hexamethylenediamine, uses and miscellaneous 1120-48-5,

Dioctylamine 35161-70-7, **N-Methylhexylamine**

(surface **modification** with, of cation-exchanger
membranes, for chromium-iron redox-flow battery separators)

L127 ANSWER 17 OF 44 HCA COPYRIGHT 2004 ACS on STN

104:150068 Fluorocarbon anion exchangers. Matsui, Kiyohide; Kikuchi,
Yoshiyuki; Hiyama, Tamejiro; Tobita, Etsuko; Kondo, Kiyosi; Akimoto,
Akira; Seita, Toru; Watanabe, Hiroyuki (Toyo Soda Mfg. Co., Ltd.,
Japan; Sagami Chemical Research Center). Eur. Pat. Appl. EP 166015
A1 **19860102**, 28 pp. DESIGNATED STATES: R: BE, CH, DE,
FR, GB, IT, LI, NL, SE. (English). CODEN: EPXXDW. APPLICATION: EP
1984-107340 19840626.

AB A fluorocarbon anion exchanger is prepd. which comprises a
perfluorocarbon main chain and pendant chains contg. terminal groups
 $\text{SO}_2\text{NR}_4(\text{CH}_2)_a\text{N}^+\text{R}_1\text{R}_2\text{R}_3$ Z⁻ (R₁ = lower alkyl, aryl, or alkyl contg.
quaternary ammonium group; R₂ = lower alkyl, aryl, or hydroxyallyl;
R₃ = lower alkyl; R₁R₂ = (CH₂)₄ or (CH₂)₅; R₄ = H, lower alkyl, or
alkyl contg. quaternary ammonium group; Z = anion; a = 2-5). The

anion exchanger is durable, is resistant to Cl, solvents, and bases, has low elec. resistance, and is useful in dialysis app., electrolysis cells, etc. Thus, a 100- μ membrane ion-exchange capacity 0.91 mequiv./g) was prepd. by copolyng. CF₂:CF₂ with CF₂:CFOCF₂CF(CF₃)OCF₂CF₂SO₂F and treating the copolymer with Me₂N(CH₂)₃NH₂, MeI, and LiCl to give a polymer (CF₂CF₂)_p[CF₂CF[OCF₂CF(CF₃)OCF₂CF₂SO₂NH(CH₂)₃N+Me₃] Cl-]_q (p/q = 6.5). The membrane had ion-exchange capacity 0.70 mequiv/g and was stable in satd. aq. Cl at 60° for 200 h, in MeOH at 65° for 48 h, and in 1N NaOH at 40° for 100 h.

IT 26654-97-7D, amides with **diamines**, quaternary **derivs.**

(anion-exchange membranes, for dialysis and electrolysis)

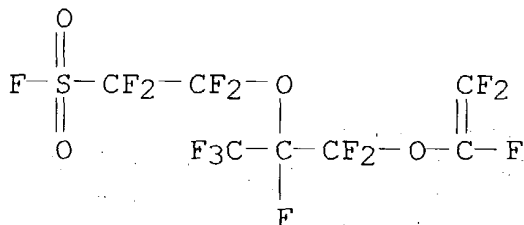
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

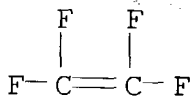
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



IC ICM B01J041-14

ICS C08J005-22; C08F008-44

CC 37-3 (Plastics Manufacture and Processing)

IT 74-88-4D, quaternization products with amino group-contg. fluoropolymers 109-01-3D, amides with fluorosulfonyl group-contg.

fluoropolymers, quaternary derivs. 109-55-7D, amides with fluorosulfonyl group-contg. fluoropolymers, quaternary derivs. 142-25-6D, amides with fluorosulfonyl group-contg. fluoropolymers, quaternary derivs. 4543-96-8D, amides with fluorosulfonyl group-contg. fluoropolymers, quaternary derivs. 10563-29-8D, amides with fluorosulfonyl group-contg. fluoropolymers, quaternary derivs. 26654-97-7D, amides with **diamines**, quaternary **derivs.**

(anion-exchange membranes, for dialysis and electrolysis)

L127 ANSWER 18 OF 44 HCA COPYRIGHT 2004 ACS on STN

98:180090 Iodinated fluoropolymers. (Sagami Chemical Research Center, Japan). Jpn. Kokai Tokkyo Koho JP 57159805 A2 **19821002** Showa, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1981-45511 19810330.

AB Iodinated fluoropolymers are prepd. by heating SO₂Cl-terminated fluoropolymers with I in alcs. under inert gases. Thus, a 5-mil film of C₂F₄-perfluoro(3,6-dioxa-4-methyl-7-octenyl)sulfonyl fluoride polymer (exchange capacity 0.85 mequiv./g) was treated with NaOH, dil. HCl, aq. **NH₃**, and 1:1 PCl₅-POCl₃ to convert SO₂F to SO₂Cl. The film was refluxed in I-satd. MeOH under Ar for 15 h and then 4.5 h in EtOH to give a polymer contg. 9.8% I. IR showed appearance of a 915 cm⁻¹ peak and disappearance of the 1420 cm⁻¹ peak.

IT **26654-97-7DP**, iodo derivs.
(prepn. of)

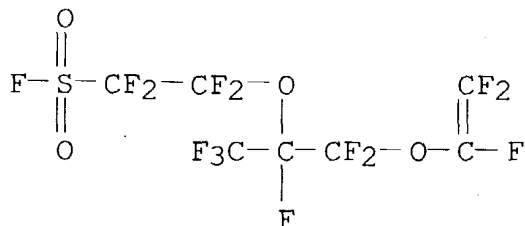
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

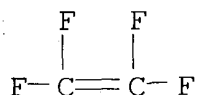
CRN 16090-14-5

CMF C7 F14 O4 S



CM 2

CRN 116-14-3
CMF C2 F4



IC C08F008-22
CC 35-8 (Chemistry of Synthetic High Polymers)
IT 26654-97-7DP, iodo derivs.
(prepn. of)

L127 ANSWER 24 OF 44 HCA COPYRIGHT 2004 ACS on STN

91:141819 Cation exchange membrane by treatment of fluorinated polymer containing sulfonyl halide groups with amine and vinyl monomer. Seita, Toru; Takahashi, Kenji; Asami, Shunichi; Shimizu, Akihiko (Toyo Soda Mfg. Co., Ltd., Japan). U.S. US 4154909 19790515, 6 pp. (English). CODEN: USXXAM. APPLICATION: US 1978-929499 19780731.

AB Cation exchange membranes having good current efficiency and crosslinked structure comprise a sulfonyl halide group-contg. perfluorinated copolymer treated with an amine -halogenated vinyl monomer reaction product and an unsatd. carboxylic acid. Thus, acrylic acid 4, divinylbenzene 2, and Bz2O2 0.05 parts were added to 10 parts reaction product of 1 mol ethylenediamine and 0.5 mol p-chloromethylstyrene. The mixt. was impregnated into 1 side of a perfluoro-2-[2-ethyleneoxy-(1-methylethoxy)]-ethanesulfonyl fluoride-tetrafluoroethylene copolymer membrane. The membrane was hydrolyzed and tested in an electrolytic cell to give elec. resistivity 5.8 Ω cm² and current efficiency to 30% NaOH 87%.

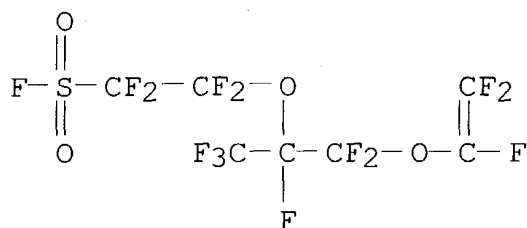
IT 26654-97-7D, reaction products with amines, halogenated vinyl monomers and unsatd. carboxylic acid
(crosslinked, cation exchange membranes)

RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

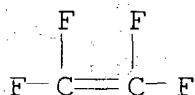
CRN 16090-14-5
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



IC C25B001-46; C08F008-30

NCL 521032000

CC 37-3 (Plastics Fabrication and Uses)

IT 79-10-7D, reaction products with perfluorinated sulfonyl halide copolymers, amines and halogenated vinyl monomer 107-15-3D, reaction products with perfluorinated sulfonyl halide copolymer, halogenated vinyl monomer and unsatd. carboxylic acids 112-57-2D, reaction products with perfluorinated sulfonyl halide copolymer, halogenated vinyl monomer, and unsatd. carboxylic acids 392-41-6D, reaction products with perfluorinated sulfonyl halide copolymers, amines and halogenated vinyl monomer 626-99-3D, reaction products with perfluorinated sulfonyl halide copolymers, amines and halogenated vinyl monomer 1592-20-7D, reaction products with perfluorinated sulfonyl halide copolymers, amines and unsatd. carboxylic acids 2628-16-2D, reaction products with perfluorinated sulfonyl halide copolymers, amines and halogenated vinyl monomer **26654-97-7D**, reaction products with amines, halogenated vinyl monomers and unsatd. carboxylic acid 45817-37-6D, reaction products with perfluorinated sulfonyl halide copolymers, amines and unsatd. carboxylic acids

(crosslinked, cation exchange membranes)

L127 ANSWER 36 OF 44 HCA COPYRIGHT 2004 ACS on STN

87:159184 Polyfluorocarbon-base cation exchange membranes for brine electrolysis cells. Seko, Maomi; Yamakoshi, Yasumichi; Miyauchi, Hirotsugu; Fukumoto, Mitsunobu; Watanabe, Itaru; Kimoto, Kyoji; Yokoyama, Shigeo (Asahi Chemical Industry Co., Ltd., Japan). Jpn.

Kokai Tokkyo Koho JP 52061191 19770520 Showa, 16 pp.

(Japanese). CODEN: JKXXAF. APPLICATION: JP 1975-137228 19751117.

AB Cation exchange membranes made of perfluorocarbon polymers having side chains of general formulas $\text{SO}_2\text{N}(\text{Q}_1\text{X})\text{Q}_2\text{X}$ (Q_1 = p-phenylene or C_mH_{2m} ; $m = 1-6$; Q_2 = C_nH_{2n} , $n = 0-6$; $\text{X} = \text{H}, \text{NH}_2, \text{OH}$) and/or $\text{SO}_2\text{N}(\text{Q}_3\text{X})\text{Q}_4\text{N}(\text{Q}_3\text{X})\text{SO}_2$ (cross linkage side chain; Q_3 = C_nH_{2n} , $n = 0-6$; Q_4 = p-phenylene or C_mH_{2m} , $m = 1-6$; $\text{X} = \text{H}, \text{NH}_2, \text{OH}$) are oxidized to give cation exchange membranes for a brine electrolytic cell. The cation exchange membranes have low elec. resistance and good durability, and the electrolytic cells prepd. with the membranes have good current efficiencies. Thus, $\text{F}_2\text{C}:\text{CF}_2-\text{C}(\text{F}_2):\text{CFOCF}_2\text{CF}(\text{CF}_3)\text{OCF}_2$ $\text{CF}_2\text{SO}_2\text{F}$ copolymer was made into a 250- μ thick film, and the film was used to make a bag into which MeNH_2 was introduced (at 1 atm, for 15 min) to convert SO_2 groups near the surface to SO_2NHMe groups (conversion took place to a depth of .apprx.15 μ). The film was then hydrolyzed in an aq. soln. contg. 15% NaOH and 30% Me_2SO to convert remaining SO_2F groups to SO_3H groups, then the film was treated in an aq. NaOCl soln. contg. 5% effective Cl and 10% NaOH for 24 h at 90° to convert the SO_2NHMe groups to SO_2NH_2 groups. The thus prepd. cation exchange membrane had SO_2NH_2 groups on 1 side and SO_3H groups on other side, and the cond. of the film measured in 0.1N NaOH soln. was $6.7 + 10^{-3} \Omega^{-1} \text{cm}^{-1}$. The current efficiency of the electrolytic cell, constructed such that the membrane surface with SO_2NH_2 groups faced the cathode, was .apprx.90%, when 3N NaCl and 20% NaOH solns. were circulated through anode and cathode chambers, resp., at 90° and the electrolysis was carried out at 50 A/dm^2 . The current efficiency was 89% even after 1000 h of operating the electrolytic cell.

IT 74-89-5D, reaction product with perfluoro(dioxamethyloctenesulfonal fluoride)-tetrafluoroethylene copolymer, hydrolyzed 26654-97-7D, reaction product with methylamine, hydrolyzed (cation-exchanging membrane, for brine electrolysis)

RN 74-89-5 HCA

CN Methanamine (9CI) (CA INDEX NAME)

$\text{H}_3\text{C}-\text{NH}_2$

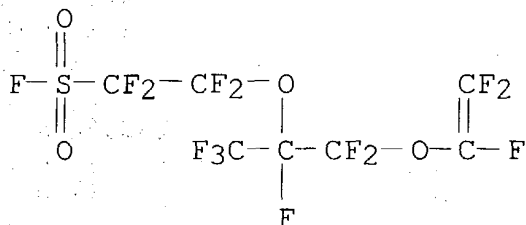
RN 26654-97-7 HCA

CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

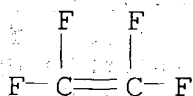
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



IC C08J005-22

CC 72-10 (Electrochemistry)

Section cross-reference(s): 49

IT **74-89-5D**, reaction product with perfluoro(dioxamethyloctenesulfonal fluoride)-tetrafluoroethylene copolymer, hydrolyzed **26654-97-7D**, reaction product with methylamine, hydrolyzed (cation-exchanging membrane, for brine electrolysis)

L127 ANSWER 38 OF 44 HCA COPYRIGHT 2004 ACS on STN

87:31186 Electrolysis cell using cation exchange membranes of improved permselectivity. Grot, Walther Gustav (du Pont de Nemours, E. I., and Co., USA). U.S. US 4026783 **19770531**, 8 pp. Division of U.S. 3,969,285. (English). CODEN: USXXAM. APPLICATION: US 1976-680872 19760427.

AB Fluorinated cation-exchange polymers are obtained from intermediate fluorinated polymers contg. pendant sulfonyl halide groups which are reacted with a di- or polyamine and subjected to elevated temp. (170-300°). The polymers are employed with pendant side groups in the salt form. Thus, a tetrafluoroethylene-perfluoro(3,6-dioxa-4-methyl-7-octenesulfonyl fluoride) copolymer was **treated** with **ethylenediamine** by folding in a bag and contact was made with the entire inner surface of the bag. This treated film was laminated on a outside surface with T-12 (Teflon) and the remaining pendant sulfonyl fluoride groups were converted to a potassium sulfonate by immersing the laminate in 15% KOH and 30%

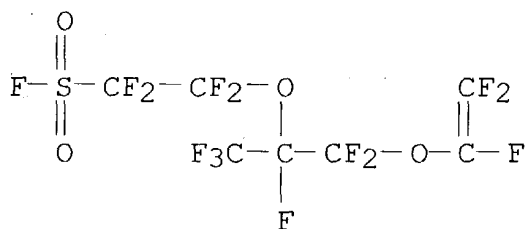
Me₂SO in water for 6 h at 60°. The laminate was placed in a chlor-alkali cell with the **amine treated** side to the cathode. In electrolysis, the brine and NaOH circulated in their resp. half cells (at 85°) contg. a dimensionally stable anode and perforated stainless steel cathode and a current efficiency of 96% was obtained at a cell voltage of 4.7 V giving a NaOH concn. of 17%.

IT 26654-97-7D, reaction products with amines
(diaphragm, cation-exchanging, for brine electrolysis)
RN 26654-97-7 HCA
CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

CM 1

CRN 16090-14-5

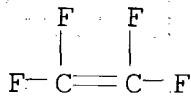
CMF C7 F14 O4 S



CM 2

CRN 116-14-3

CMF C2 F4



IC C25C013-08

NCL 204266000

CC 72-10 (Electrochemistry)

Section cross-reference(s): 49

IT Brines

(electrolysis of, **amine-treated** fluorinated cation-exchange polymer diaphragms for)

IT Electrolytic cells

(diaphragm, from **amine-treated** fluorinated

- cation-exchange polymers, for brines)
- IT Cation exchangers
(membranes, from **amine-treated** fluorinated polymers, for brines)
- IT 107-15-3D, reaction product with tetrafluoroethylene-perfluoro-(dioxamethyloctenesulfonyl fluoride) copolymer, hydrolyzed, potassium salt 111-40-0D, reaction product with tetrafluoroethylene-perfluoro-(dioxamethyloctenesulfonyl fluoride) copolymer **26654-97-7D**, reaction products with amines (diaphragm, cation-exchanging, for brine electrolysis)
- IT 1310-73-2P, preparation
(manuf. of, electrochem., **amine-treated** fluorinated cation-exchange polymer diaphragm for)

L127 ANSWER 41 OF 44 HCA COPYRIGHT 2004 ACS on STN

83:180686 Laminates of support material and fluorinated polymer containing pendant side chains containing sulfonyl groups. Grot, Walther G. (du Pont de Nemours, E. I., and Co., USA). U.S. US 3902947 **19750902**, 5 pp. Division of U.S. 3,849,243. (English). CODEN: USXXAM. APPLICATION: US 1974-482573 19740624.

AB A laminate was prepd. comprising a first layer of fluorinated polymer (I) contg. pendant side chains contg. SO₂NHK and a second layer of fluorinated polymer (II) [**26654-97-7**], prepd. by copolyng. 7.5 mole C₂F₄ with 1 mole CF₂:CFOCF₂CF(CF₃)OCF₂CF₂SO₂F, a support material, e.g. poly(tetrafluoroethylene) [**9002-84-0**] fabric. The lamination was done at 280-5° at 20 in. Hg pressure. The fabric was completely encapsulated, i.e., II had fused together under the fabric to form a continuous unbroken surface, while I had formed an unbroken upper surface. I was prepd. by immersing II in boiling NH₃ contg. KNH₂.

IT **9002-84-0**
(fabric, encapsulated in fluorinated polymer contg. sulfonyl groups)

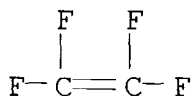
RN 9002-84-0 HCA

CN Ethene, tetrafluoro-, homopolymer (9CI) (CA INDEX NAME)

CM 1

CRN 116-14-3

CMF C₂ F₄

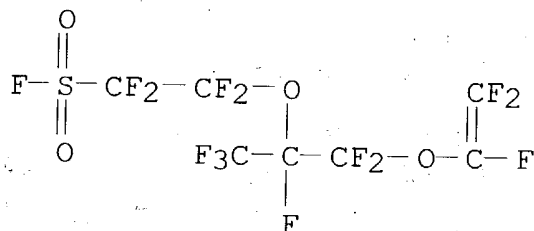


IT **26654-97-7**
(laminates, contg. encapsulated poly(tetrafluoroethylene) fabric)

RN 26654-97-7 HCA
 CN Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene (9CI) (CA INDEX NAME)

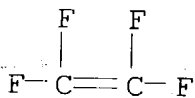
CM 1

CRN 16090-14-5
 CMF C7 F14 O4 S



CM 2

CRN 116-14-3
 CMF C2 F4



IC B32B
 NCL 156213000
 CC 37-3 (Plastics Fabrication and Uses)
 IT Ethanesulfonyl fluoride, 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoro-, polymer with tetrafluoroethene, reaction products with ammonia and potassium amide
 Ethene, tetrafluoro-, polymer with 2-[1-[difluoro[(trifluoroethenyl)oxy]methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoroethanesulfonyl fluoride, reaction products with ammonia and potassium amide (laminates, contg. encapsulated poly(tetrafluoroethylene) fabric)
 IT 9002-84-0 (fabric, encapsulated in fluorinated polymer contg. sulfonyl groups)
 IT 26654-97-7 (laminates, contg. encapsulated poly(tetrafluoroethylene) fabric)

L127 ANSWER 42 OF 44 HCA COPYRIGHT 2004 ACS on STN

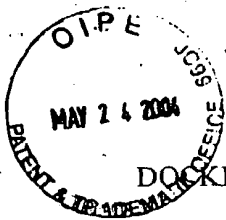
83:80327 N-Monosubstituted sulfonamido groups-containing, fluorine-containing ion exchanging polymers. Resnick, Paul R.; Grot, Walther G. (du Pont de Nemours, E. I., and Co., USA). Ger. Offen. DE 2437395 **19750417**, 28 pp. (German). CODEN: GWXXBX. APPLICATION: DE 1974-2437395 19740802.

AB A copolymer (I) [**26654-97-7**] of CF₂:CF₂ and CF₂:CFOCF₂CF(CF₃)OCF₂CF₂SO₂F was treated, as a film, with 1,2-ethanediamine (II) [107-15-3], MeNH₂ [**74-89-5**], or another amine to give substituted sulfonamido groups on the film surfaces. The films were useful in electrolysis cells used for Cl₂ manuf. Thus, a 0.127 mm film of I was treated on one side with II for 15 min to give a film contg. substituted sulfonamido groups to a depth of 0.0178 mm. The remaining sulfonyl fluoride groups were converted to SO₃K groups during 6 hr at 60° in water contg. KOH and Me₂SO. The film was used in an electrolysis cell to manuf. Cl₂, giving a current yield of 91% with cell voltage 3.6 volts.

IC C08L

CC 36-4 (Plastics Manufacture and Processing)

Section cross-reference(s): 49



DOCKET NO: 219871US0

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :

HIROMITSU TANAKA, ET AL.

: EXAMINER: LE, HOA VAN

SERIAL NO: 10/079,873 :

FILED: FEBRUARY 22, 2002

: GROUP ART UNIT: 1752

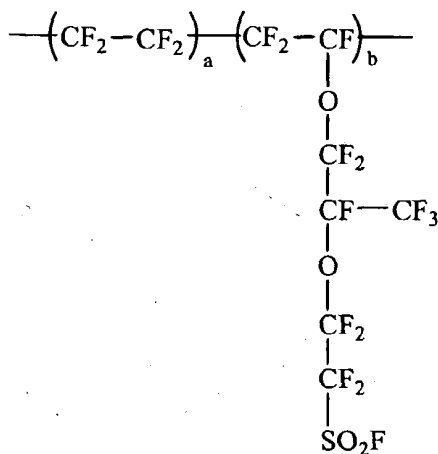
FOR: PROCESS FOR PRODUCING A
MODIFIED ELECTROLYTE AND THE
MODIFIED ELECTROLYTE

RESPONSE TO ELECTION OF SPECIES REQUIREMENT

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

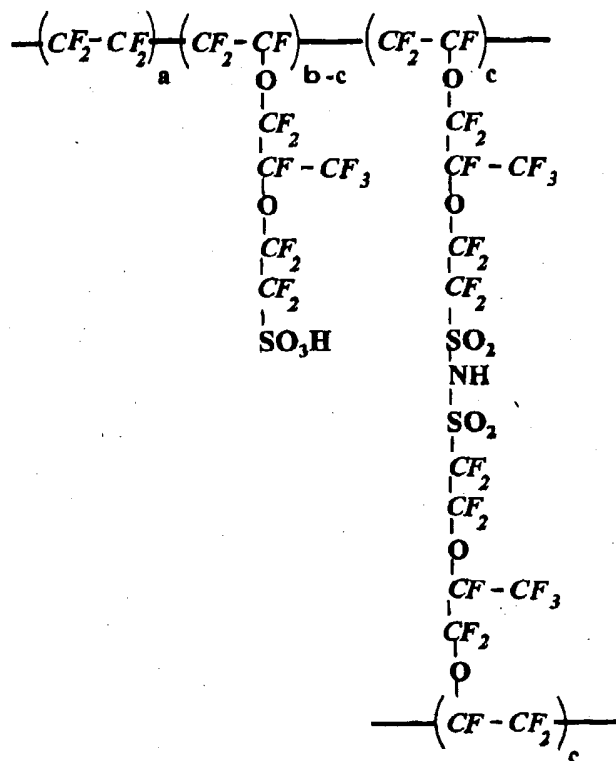
SIR:

In response to the Election Requirement mailed March 24, 2004, Applicants elect with traverse, the following species for examination purposes only. Claims 1-20 read on the elected species. Applicants elect with traverse the following solid polymer electrolyte for examination purposes only:



Applicants also elect with traverse ammonia (NH₃) for the chemical modifying electrolyte compound (amine compound), for examination purposes only. Applicants elect with traverse trimethylamine for the chemical base, for examination purposes only. Applications also elect with traverse the following crosslinking group, -O₂S-NH-SO₂-, for examination purposes only.

To assist the Examiner, Applicants direct the Examiner's attention to Examples 16-22 (pages 55-56) and pages 14, 15, 17-19 and 46 of the specification, in which some exemplary embodiments of the elected species are provided. Although not required for the election, Applicants note that the above elected species can result in the following modified electrolyte:



1/5

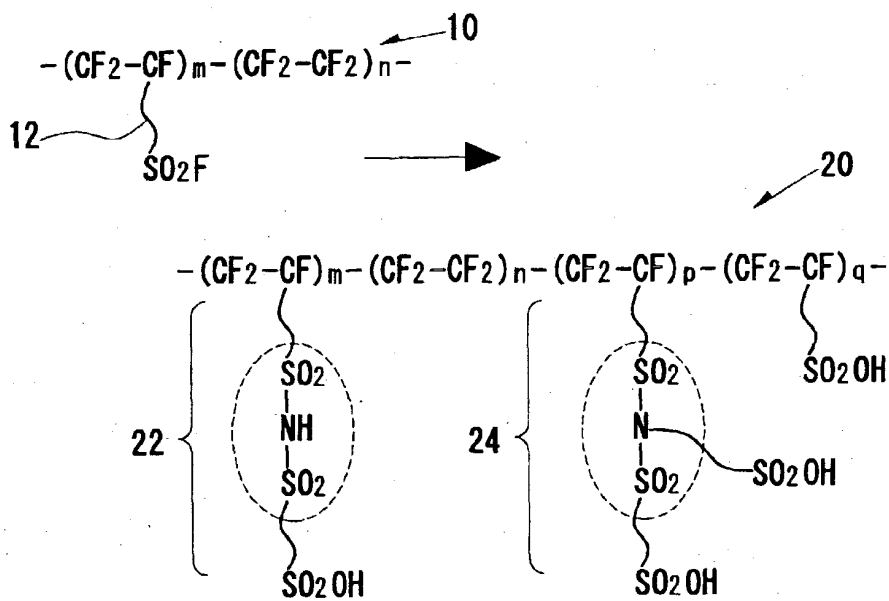


FIG. 1

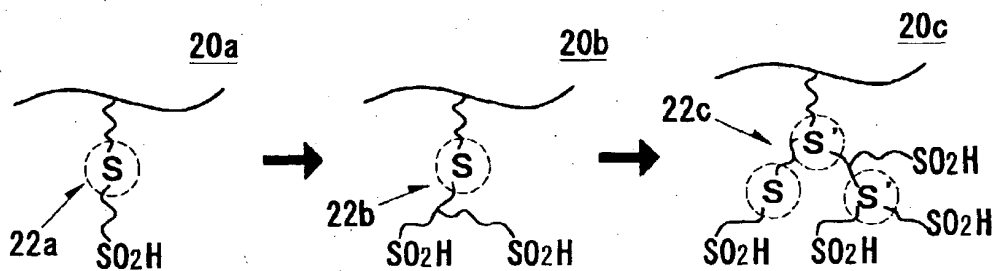


FIG. 2A

FIG. 2B

FIG. 2C

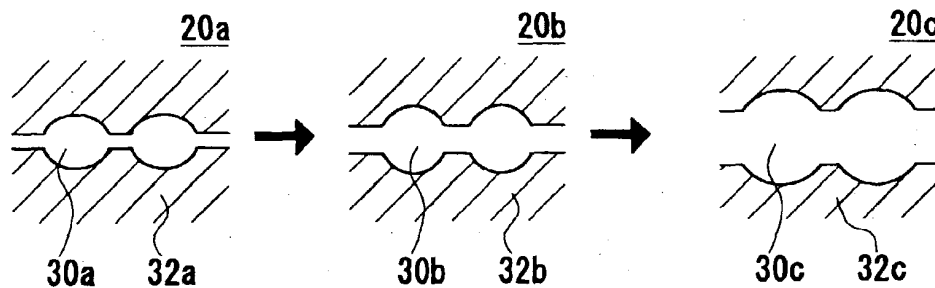


FIG. 2D

FIG. 2E

FIG. 2F

PROCESS FOR PRODUCING A MODIFIED ELECTROLYTE AND
THE MODIFIED ELECTROLYTE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention concerns a process for producing a modified electrolyte and a modified electrolyte and, more in particular, it relates to a process for producing a modified electrolyte as well as a modified electrolyte suitable to an electrolyte membrane for use in fuel cells, water electrolysis apparatus, halogen hydric acid electrolysis apparatus, sodium chloride electrolysis apparatus, hydrogen and/or oxygen concentrators, humidity sensors and gas sensors.

2. Description of the Related Art

Solid polymer electrolytes are solid polymer materials having electrolyte groups such as sulfonic groups in the polymer chains and since they have a property of strongly bonding with specific ions and selectively permeating cations or anions, they are utilized in various application uses, being formed into granules, fibers or membranes.

For example, a solid polymer fuel cell has a pair of electrodes on both surfaces of an electrolyte membrane in which a fuel gas containing hydrogen such as a modified gas is supplied to one electrode (fuel electrode) while an oxidant gas containing oxygen such as air is supplied to the other electrode (air electrode) and chemical energy generated upon oxidation of the fuel is taken out directly as electric energy.

In the solid polymer fuel cell, a solid polymer electrolyte membrane having a proton conductivity is used as an electrolyte membrane.

Further, an SPE electrolytic method is a method of producing hydrogen and oxygen by electrolysis of water in which a solid polymer electrolyte membrane having proton conductivity is used instead of existent aqueous alkali solutions.

Known solid polymer electrolytes used in such application uses include, for example, non-crosslinked perfluoro polymer electrolytes typically represented by Nafion (registered trade mark of products manufactured by E.I. duPont de Nemours and Company). Since the perfluoro polymer electrolyte is highly chemically stable, it has been recommended as an electrolyte membrane used under severe conditions such as in fuel cells and SPE electrolysis.

Further, Journal of Fluorine Chemistry, vol. 72 (1995) pp 203 to 208 proposes a bis(perfluoroalkylsulfonyl)imide group as a novel acid group and discloses bis(perfluoroalkylsulfonyl)imide polymer having a structure similar to Nafion synthesized by copolymerization of perfluoro vinyl ether having two bissulfonylimide groups in ether moieties and tetrafluoro ethylene.

Further, US Patent No. 5,741,408, issued on April 21, 1998 to Freddy Helmer-Metzmann et al., discloses a crosslinked hydrocarbon polymer electrolyte membrane obtained by introducing a sulfonyl halide group into an aromatic polyether

ketone, by reacting the introduced sulfonyl halide group with an UV-curing type amine crosslinker, and then, by conducting crosslinking reaction by the amine crosslinker.

Further, the present applicant discloses, in Japanese Patent Unexamined Publication No. 2000-188013, a highly heat resistant polymer electrolyte in which a perfluoro polymer compound is crosslinked by way of a strongly acidic crosslinking group comprising, for example, bissulfonyl imide, sulfonylcarbonyl imide, biscarbonyl imide or bissulfonyl methylene.

It has been known that the solid polymer fuel cell increases the power generation efficiency as the working temperature of the cell is higher. Further, a platinum series electrode catalyst is contained in electrodes bonded on both surfaces of the solid polymer electrolyte, and platinum is poisoned even with a small amount of carbon monoxide to lower the output of the fuel cell. Moreover, it has been known that the poisoning of the electrode catalyst by carbon monoxide increases more remarkably with decreasing temperature.

In view of the above, in the solid polymer fuel cell using a gas containing a slight amount of carbon monoxide such as a methanol reformed gas as a fuel gas, it has been desired to increase the working temperature in order to increase the efficiency and reduce the poisoning of the electrode catalyst with carbon monoxide.

Further, in the electrolysis of water, it has been known that the total energy required for the electrolysis of water

does not change considerably depending on the temperature, but the minimum voltage required for the electrolysis of water, that is, the theoretical decomposition voltage, is lower as the temperature is higher. Therefore, if it is possible to supply a heat energy from the outside to the system and conduct electrolytic reaction at a high temperature, consumption of expensive electric energy can be reduced, which is advantageous in view of the efficiency.

Further, any of the existent solid polymer electrolytes requires water for developing the proton conductivity. Accordingly, in the solid polymer fuel cell, when the operation condition is in a dry condition, membrane resistance increases due to the drying of the electrolyte membrane to lower the output. In the existent solid polymer fuel cells, this is avoided by humidification of the electrolyte membrane using auxiliary equipment. However, the humidification with auxiliary equipment lowers the efficiency of the fuel cell, and increases the scale of the system. Therefore, in the fuel cell, there have been demands for an electrolyte membrane that shows high electric conductivity even under low humidity/high temperature condition in order to attain a high cell performance.

However, the perfluoro polymer electrolyte typically represented by Nafion has low heat resistance since it is not crosslinked and has a property of creeping at 130 °C or higher near the glass transition temperature. Therefore, when the perfluoro polymer electrolyte is used for a fuel cell or an

10079073-00000000

SPE electrolysis apparatus, it is necessary that the working temperature is 100 °C or lower. If this is the case, the electrolyte cannot be used at high temperatures, and it is disadvantageous in preventing the electrode catalyst from being poisoned by carbon monoxide and in view of efficiency.

Further, in the fuel cell using the electrolyte membrane synthesized from a monomer having an electrolyte group such as Nafion, since the electric conductivity of the electrolyte membrane is insufficient, no high cell performance is obtained under low humidity/high temperature condition. On the other hand, when the content of the monomer having an electrolyte group is increased in order to improve the electric conductivity of the electrolyte membrane, crystallinity of the main chain is lowered. Thus, this results in a problem that the strength of the electrolyte membrane is lowered or the electrolyte membrane swells or solubilizes remarkably in water and its shape can no more be maintained.

Further, when the bis(perfluoroalkylsulfonyl)imide polymer as disclosed in Journal of Fluorine Chemistry, vol. 72 (1995), pp 203 to 208 is used, since perfluoro vinyl ether is bulky compared with tetrafluoro ethylene, there is a concern that no sufficient molecular weight is obtained by copolymerization, which might result in lack of membrane strength.

Further, since the bis(perfluoroalkylsulfonyl)imide polymer is not crosslinked, it involves a problem in heat resistance as with the case of Nafion. One possible solution

to the problem may be to introduce a crosslink structure upon copolymerization of the imide polymer. However, when the crosslink structure is introduced upon copolymerization, the polymer becomes insoluble, making it difficult to form the polymer into a membrane or the like, so that no homogeneous membrane can be obtained.

Further, the method of crosslinking by the use of the UV-curing type amine crosslinker, as disclosed in US Patent No. 5,741,408, involves a problem that the electric conductivity lowers as the crosslinking density increases, because the electrolyte groups are consumed by the reaction with the crosslinker.

On the other hand, in the highly heat resistant polymer electrolyte proposed by the present applicant, since the perfluoro polymer electrolyte is crosslinked by way of the strongly acidic crosslinking group, the strength can be improved without greatly decreasing the amount of the electrolyte groups. However, in order to further enhance the performance of an electrochemical device used under severe conditions such as in fuel cells or an SPE electrolysis apparatus, it has been desired to further improve the heat resistance, the strength and the electric conductivity of the electrolyte used for the device.

SUMMARY OF THE INVENTION

The present invention has been achieved in view of the situations described above and it has an object to overcome

the foregoing problems and provide a process for producing a modified electrolyte excellent in heat resistance, strength and electric conductivity, as well as such a modified electrolyte.

Another object of the present invention is to provide a process for producing a modified electrolyte capable of maintaining high electric conductivity, even when a crosslinking density is increased, as well as such a modified electrolyte.

Further, another object of the present invention is to provide a process for producing a modified electrolyte having high performance even when it is applied to an electrochemical device used under severe conditions, as well as such a modified electrolyte.

Additional objects and advantages of the invention are set forth in the following description, are obvious from the description, or may be learned by practicing the invention. The objects and advantages of the invention may be realized and attained by means of instrumentalities and combinations particularly pointed out in the claims.

A first process for producing a modified electrolyte according to the present invention in order to solve the problems has a feature that it comprises an amine treatment step of contacting a solid polymer electrolyte or a precursor thereof with an amine compound.

In a preferred embodiment, a heat treatment step of heating the solid polymer electrolyte or the precursor thereof

is further provided after the amine treatment step, preferably. Further, in a preferred embodiment, a base treatment step of contacting the solid polymer electrolyte or the precursor thereof with a base is further provided after the amine treatment step, preferably.

In addition, a first modified electrolyte according to the present invention consists essentially of what is produced in such a process.

The first process for producing a modified electrolyte according to the present invention provides a modified electrolyte excellent in durability, heat resistance, and high temperature creep resistance with electric conductivity kept high since it comprises the amine treatment step.

Further, a second process for producing a modified electrolyte according to the present invention has a feature that it comprises a first step of introducing, to a solid polymer compound having a functional group A, a first modifying agent comprising: at least one functional group B capable of reacting with the functional group A, thereby forming a first intermediate acid group; and at least one functional group C capable of forming a terminal acid group or a second intermediate acid group; and that the first step also includes reacting the functional group A with the functional group B.

A preferred embodiment may further comprises a second step of: introducing, to the solid polymer compound having been reacted with the first modifying agent, a second modifying agent comprising: at least one functional group D capable of

reacting with the first or second intermediate acid group; and at least one functional group E capable of forming a terminal acid group or a third intermediate acid group, and the second step also includes reacting the first or second intermediate acid group with the functional group D.

Further, a second modified electrolyte according to the present invention has a feature that it comprises a solid polymer compound having side chains, at least one terminal acid group present at the terminal ends of the side chains, and at least one intermediate acid group and/or modified acid group present within the side chains identical with the side chains containing the terminal acid group.

In a preferred embodiment, the intermediate acid group is preferably at least one selected from the group consisting of a bissulfonyl imide group, a sulfonyl carbonyl imide group, and a biscarbonyl imide group. Further in a preferred embodiment, the terminal acid group is preferably at least one selected from the group consisting of a sulfonic acid group, a carboxylic acid group, and a phosphonic acid group.

Further in a preferred embodiment, a crosslinking group for crosslinking the solid polymer compounds to one another may further be provided. Further, in a preferred embodiment, the crosslinking group is preferably at least one selected from the group consisting of a bissulfonyl imide group, a sulfonylcarbonyl imide group, and a biscarbonyl imide group.

Since plural acid groups are introduced into one side chain constituting the solid polymer compound in the modified

electrolyte according to the present invention, the modified electrolyte shows higher electric conductivity compared with existent solid polymer electrolytes each having a similar structure of the main chain and one acid group introduced into the side chain. Further, the amount of acid groups in the entire electrolyte can be controlled depending on the number of acid groups introduced into the side chains, and the introduction of the acid groups does not change the structure of the main chain. Therefore, electric conductivity of the modified electrolyte can be improved without deteriorating crystallinity in the main chain that contributes to the strength of the modified electrolyte.

Further, when a crosslink structure is further introduced to the modified electrolyte to which the terminal acid group and the intermediate acid group and/or modified acid group have been introduced into the same side chains, flows of molecules at high temperatures are suppressed, thereby greatly improving high temperature creep resistance. Therefore, when this is used in various kinds of electrochemical devices used at high temperatures, the working temperature of the device can be increased, thereby improving efficiency outstandingly. Further, when the modified electrolyte is used as an electrolyte membrane for use in a fuel cell, it can provide a fuel cell that operates stably even under the condition of low humidity and high temperatures.

The modified electrolyte having such a structure can be produced by introducing, to the solid polymer compound

having the functional group A, a first modifying agent comprising at least one functional group B capable of reacting with the functional group A thereby forming a first intermediate acid group and at least one functional group C capable of forming a terminal acid group or a second intermediate acid group, and by reacting the functional group A with the functional group B.

DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The drawings appended to the specification and constituting a portion of the specification illustrate examples of the invention which is useful, in conjunction with the specification, for explaining the purposes, advantages and the principles of the invention, wherein:

Fig. 1 is a conceptional view for a modified electrolyte according to a second embodiment of the present invention;

Figs. 2A to 2F are conceptional views explaining a relation between the amount of acid groups introduced into side chains and the thickness of a conductive path in the modified electrolyte shown in Fig. 1;

Fig. 3 is a graph showing a relation between a nitrogen molar fraction: $N_{sul}(\%)$ to the total number of sulfonic acid groups contained in the modified electrolyte according to a first embodiment of the present invention, and creep elongation in one minute and electric conductivity;

Fig. 4 is a graph showing a nitrogen density distribution over a cross section of the modified electrolyte

according the first embodiment of the present invention to which an amine treatment has been applied using LBTMSA;

Fig. 5 is a graph showing a nitrogen density distribution over a cross section of the modified electrolyte according to the first embodiment of the present invention to which an amine treatment has been applied using ammonia; and

Fig. 6 is a graph showing a relation between the cell temperature and the output voltage of fuel cells using the electrolyte according to a second embodiment of the present invention and using an existent solid polymer electrolyte.

DESCRIPTION OF PREFERRED EMBODIMENTS

Preferred embodiments according to the present invention are to be described in details. The process for producing a modified electrolyte according to a first embodiment of the present invention comprises an amine treatment step.

The amine treatment step is to be described. The amine treatment step is a step of contacting a solid polymer electrolyte or a precursor thereof and an amine compound.

In this embodiment, the solid polymer electrolyte may be a hydrocarbon polymer electrolyte containing only the C-H bonds in the polymer chain, or a fluoro polymer electrolyte containing C-F bonds in the polymer chain.

Further, the fluoro polymer electrolyte may be an electrolyte in which electrolyte groups are bonded to the main chain or side chains of a polymer compound containing both C-F

bonds and C-H bonds in the polymer chain, or an electrolyte in which electrolyte groups are bonded to the main chain or the side chains of a polymer compound containing C-F bonds and not containing C-H bonds (hereinafter referred to as "perfluoro polymer compound") (such an electrolyte will hereinafter be referred to as "perfluoro polymer electrolyte"). The perfluoro polymer electrolyte may also contain C-Cl bonds or other bonds (for example, -O-, -S-, -C(=O)-, -N(R)-), in addition to C-F bonds.

In this embodiment, the precursor of the solid polymer electrolyte means those having a structure in which electrolyte groups contained in a solid polymer electrolyte are substituted with functional groups capable of forming electrolyte groups through derivation caused by chemical reaction (such a functional group will hereinafter be referred to as "electrolyte group precursor").

The perfluoro polymer compound may preferably include, polytetrafluoroethylene, tetrafluoroethylene-perfluoroalkylvinyl ether copolymer, tetrafluoroethylene-hexafluoropropylene copolymer, tetrafluoroethylene-hexafluoropropylene-perfluoroalkylvinyl ether copolymer, and polychlorotrifluoroethylene.

Further, the electrolyte or the electrolyte group precursor (shown with "*") may preferably include: -SO₃H; -SO₂F*; -SO₂Cl*; -SO₂Br*; -SO₃Na; -SO₃K; -SO₃Li; -SO₃Mg; -SO₃Ca; -CO₂H; -COF*; -COCl*; -COBr*; -CONa; -COK; -COLi; -COMg; -COCa; -PO₃H₂; =PO₂H; -OP(O₂H)O-; -OPO₃H₂; -OPOCl₂*; -OPOF₂*;

-OPOBr₂*; -POCl₂*; -POF₂*; -POBr₂*; -OP(OCl)O-*; -OP(OF)O-*;
-OP(OLi)O-; carboxylate ester*; sulfonate ester*; phosphate
ester*; carboxylic acid anhydride*; sulfonic acid anhydride*;
phosphoric acid anhydride*; and a mixture of carboxylic acid,
sulfonic acid, and phosphoric acid anhydrides*.

There is no particular restriction on the structure of
the solid polymer electrolyte or the precursor thereof used
herein, and its polymer chain may have either a linear structure
or a branch structure.

For obtaining a modified electrolyte excellent in heat
resistance and oxidation resistance, the solid polymer
electrolyte or the precursor thereof is preferably perfluoro
polymer electrolyte or the precursor thereof having -SO₃H
(sulfonic acid group) or -SO₂F (sulfonyl fluoride group) as
the electrolyte group or the electrolyte group precursor in
its chemical structure (particularly, in the side chain), such
as Nafion (registered trade mark) or the precursor thereof
manufactured by E. I. DuPont de Nemours and Company.
Particularly, the sulfonyl fluoride group is preferred as the
electrolyte group precursor since the creep resistance can be
improved easily by the amine treatment as described later.

"Amine compound" used in the amine treatment step in
this embodiment means a compound in which hydrogen atoms of
ammonia are substituted with 0 to three substituents.

The substituent in this case may preferably include,
an alkyl group, an aryl group, an allyl group, an alkene group,
an alkyne group, an alkoxy group, a hydroxy group, a hydroxyl

group, a hydroxylate group, a thiocarboxy group, a dithiocarboxy group, a sulfo group, a sulfino group, a sulfeno group, an oxycarbonyl group, a haloformyl group, a carbamoyl group, a hydrazinocarbonyl group, an amidino group, a cyano group, an isocyan group, a cyanate group, an isocyanate group, a thiocyanate group, an isothiocyanate group, a formyl group, an oxo group, a thioformyl group, a thioxo group, a mercapto group, an amino group, an imino group, a hydrazino group, an aryloxy group, a sulfide group, a halogen group, a nitro group, and a silyl group.

Further, the substituent may be a metal, for example, Li, Na, K, Rb, Cs, Fr, Be, Mg, Ca, or Ba. The amine compound with such a substituent is referred to as a metal amide.

Among all, as the amine compound, it may be preferred to use ammonia, alkali metal(bis(trimethylsilyl)amide, sodium amide, or a primary amine compound which is an amine compound in which one hydrogen atom of ammonia has been substituted with any of the above-described substituents.

The primary amine compound used for the amine treatment may preferably include, 1-hexylamine, ethylamine, butylamine, pentylamine, heptylamine, nonylamine, decylamine, perfluoromethylamine, perfluoroethylamine, perfluorobutylamine, perfluoropentylamine, and perfluoroheptylamine.

More preferably, ammonia may be used preferably as it is as the amine compound.

The method of contacting the solid polymer electrolyte

or the precursor thereof with the amine compound may preferably include, a method of directly contacting a solid polymer electrolyte or a precursor thereof with an amine compound, a method of dissolving an amine compound in an appropriate solvent and contacting the same with a solid polymer electrolyte or a precursor thereof, and a method of exposing a solid polymer electrolyte or a precursor thereof to a vapor of an amine compound.

Further, there is no particular restriction on the solvent for dissolving the amine compound so long as it dissolves the amine compound, but those dissolving the amine compound by 10 mg/L or more are preferred. The solvent having high solubility may preferably include, fluoro type R113 or AK225.

The temperature upon amine treatment is preferably within a range from -30 °C to 200 °C. The treatment rate is lowered remarkably by degradation in the molecular motion in the perfluoro polymer electrolyte at temperatures lower than -30 °C, whereas decomposition of the perfluoro polymer electrolyte is caused at temperatures higher than 200 °C, both of which are not preferred.

Further, the contact time and the addition amount of the amine compound can properly be adjusted depending on the kind of the amine compound within the boundaries of improving the creep resistance and not remarkably lowering the electric conductivity, with no particular restriction.

When the amine treatment is applied to a solid polymer

electrolyte or a precursor thereof, part of the solid polymer electrolyte or the precursor thereof is crosslinked by the amine compound. The process for producing the modified electrolyte according to the present invention may further comprise a step for promoting the crosslinking caused by the amine compound after the amine treatment step.

This kind of step may preferably include, a heat treatment step and a base treatment step. One or both of the heat treatment step and the base treatment step may be conducted. When both of the heat treatment and the base treatment are conducted, the base treatment may be conducted after the heat treatment, or the heat treatment may be conducted after the base treatment.

Particularly, when the amine treatment, the base treatment and the heat treatment are conducted in this order to the solid polymer electrolyte or the precursor thereof, it provides an advantage that the heat resistance and the creep resistance can be improved with almost no decrease in the electric conductivity.

The heat treatment step is a step of heating a solid polymer electrolyte or a precursor thereof which has been in contact with an amine compound.

This step is preferably conducted at a heating temperature within a range of 40 °C to 200 °C. The reaction rate is remarkably low at temperatures lower than 40 °C, whereas decomposition of the solid polymer electrolyte occurs at temperatures higher than 200 °C, both of which are not preferred.

For attaining a high reaction rate, it is preferred to conduct heating near the softening point of the solid polymer electrolyte or the precursor thereof (in a range from 100 to 150 °C in the case of Nafion).

Further, the heating time may be adjusted properly depending on the addition amount, the kind, and the treatment time of the amine compound within the boundaries of improving the creep resistance and not remarkably lowering the electric conductivity, with no particular restriction.

The base treatment step is a step of contacting the solid polymer electrolyte or the precursor thereof, which has been in contact with the amine compound, further with the base.

The method of contacting the solid polymer electrolyte or the precursor thereof with the base may preferably include: a method of directly contacting the solid polymer electrolyte or the precursor thereof with a base; a method of dissolving a base in an appropriate solvent and contacting the same with a solid polymer electrolyte or a precursor thereof; and a method of exposing a solid polymer electrolyte or a precursor thereof to a vapor of a base.

Further, there is no particular restriction on the solvent for dissolving the base so long as it dissolves the base, but those dissolving the base by 10 mg/L or more are preferred. The solvent having high solubility may include, for example, a fluoro type R113 or AK225, preferably.

Further, the base treatment time may be adjusted properly depending on the addition amount, the kind, and the

2020-03-03 14:00:00

treatment temperature of the base within the boundaries of improving the creep resistance and not remarkably lowering the electric conductivity, with no particular restriction.

The base used in the base treatment step may preferably include: amine compounds such as trimethylamine, triethylamine, pyridine, DBU (1,8-diazabicyclo[5.4.0]-7-undecane), or DBN (1,5-diazabicyclo[4.3.0]non-5-ene);

metal base such as sodium hydroxide, lithium hydroxide, calcium hydroxide, aluminum hydroxide, potassium hydroxide, sodium carbonate, potassium carbonate, sodium hydrogen carbonate, or sodium alkoxide;

metal hydrides such as sodium hydride, potassium hydride, calcium hydride, lithium aluminum hydride, or sodium borohydride; and

organic metal compounds such as butyl lithium, sodium cyclopentadienide, or phenyl lithium.

According to the process for producing the modified electrolyte of this embodiment, a modified electrolyte in which the content of nitrogen derived from the amine compound relative to the total number of electrolyte groups or electrolyte group precursors in the solid polymer electrolyte (hereinafter referred to as "nitrogen molar fraction N (%)") is 0.1 % or more and 85 % or less.

In a case where the nitrogen molar fraction N(%) is less than 0.1 %, there is less effect of improving the durability and the heat resistance since the amount of crosslinking formed among the polymer chains is insufficient. On the other hand,

when it exceeds 85 %, it is difficult to use the resultant as the electrolyte since the amount of the electrolyte groups is remarkably decreased.

Further, in a case of a solid polymer electrolyte membrane obtained by molding the resultant modified electrolyte into a membrane shape, it is preferred that the nitrogen molar fraction $N(\%)$ per unit volume at each position in the direction of the membrane cross section (hereinafter referred to as nitrogen density $n(\%)$) is as uniform as possible over the membrane cross section. Further, the maximum value n_{\max} for the nitrogen density $n(\%)$ is preferably within a range of 0.1 % or more and 50 % or less.

If the nitrogen derived from the amine compound is distributed unevenly in the membrane, that is, if there exist peaks locally in the distribution of the nitrogen density $n(\%)$, some portion of the membrane contains a significantly small amount of electrolyte groups, and the electric conductivity is lowered accordingly, which is not preferred.

The distribution of the nitrogen density $n(\%)$ can be controlled by various conditions such as the amount and the kind of the amine compound used in the amine treatment step. For obtaining a modified electrolyte in which the distribution of the nitrogen density $n(\%)$ is uniform, it is preferred to use an amine compound for the amine treatment step of which diffusion rate in the solid polymer electrolyte or the precursor thereof is higher than its reaction rate with the solid polymer electrolyte or the precursor thereof.

When the amine treatment is conducted by using an amine compound having a diffusion rate lower than the reaction rate, reaction takes place on the surface of the solid polymer electrolyte or the precursor thereof before the amine compound permeates the inside of the solid polymer electrolyte or the precursor thereof. Consequently, the distribution of the nitrogen density $n(\%)$ becomes uneven, thus resulting in a portion where the electric conductivity is lowered locally, which is not preferred.

The distribution of the nitrogen density $n(\%)$ can be evaluated by the distribution of the nitrogen atoms derived from the amine compound and the distribution of the physical properties of the resultant modified electrolyte (for example, distribution of a modulus of elasticity, a creep characteristic, or electric conductivity).

Further, optimizing the conditions for the amine treatment condition, the base treatment condition, and/or heat treatment condition provides a modified electrolyte in which the maximum value n_{\max} of the nitrogen density $n(\%)$ across the cross section of the membrane is within a range of 0.1 % or more and 50 % or less, and in which the conductivity in the direction perpendicular to the membrane is 0.001 S/cm or more, preferably, 0.05 S/cm or more.

As has been described above, the process for producing the modified electrolyte according to this embodiment can suppress the flow of molecules at high temperatures while maintaining the electric conductivity high, because the

process comprises the amine treatment step. Accordingly, deformation caused by softening in a high temperature region and creep occurring in long-duration use can be inhibited, by which the heat resistance and high temperature creep resistance are improved remarkably. Further, the process according to the present invention may be applied to the perfluoro solid polymer electrolyte or the precursor thereof, to obtain a modified electrolyte excellent in oxidation resistance at high temperatures.

The reason why the heat resistance and the durability can be improved while maintaining high electric conductivity remains uncertain, but it may be considered that the heat resistance and the high temperature creep resistance are improved because either covalent or ionic crosslinking caused by the amine compound is formed in a portion of the electrolyte groups or the electrolyte group precursors in the solid polymer electrolyte.

Further, it may be considered that the high electric conductivity is maintained because electrons that contribute to the bonding of hydrogen atoms are moved at the crosslinked point, being attracted by a fluoro carbon having electron attractivity, and because hydrogen atoms thus become more prone to be released as protons.

Further, it may also be considered that, if the base treatment is provided after the amine treatment, the base promotes crosslinking reaction to form crosslinking efficiently. Likewise, if the heat treatment is provided

after the amine treatment, the heating promotes crosslinking reaction to form crosslinking efficiently.

It may be considered that, particularly, when the amine treatment, the base treatment and the heat treatment are conducted in this order, synergetic effects of those treatments yield significant improvements in the heat resistance and the high temperature creep resistance with even more efficiency while maintaining the electric conductivity high.

Accordingly, in a case of using the modified electrolyte obtained in the process according to the present invention, for example, in a solid polymer type fuel cell, the cell operates stably even under a high temperature condition (120 °C or higher depending on the composition of the modified electrolyte), and the efficiency can be improved outstandingly. In addition, decrease in voltage caused by poisoning of the electrode catalyst by carbon monoxide, which is a problem in a methanol reformed fuel cell can be suppressed greatly by such a high temperature operation.

Next, a modified electrolyte and a process for producing a modified electrolyte according to a second embodiment of the present invention are to be explained. The modified electrolyte according to this embodiment comprises solid polymer compounds, terminal acid groups, and intermediate acid groups and/or modified acid groups.

At first, the solid polymer compound is to be explained. The solid polymer compound constitutes a main portion of a modified electrolyte according to this embodiment and has a

main chain that contributes to the strength of the modified electrolyte and side chains bonded to the main chain. The structure of the side chain may have either a linear or branch structure, with no particular restriction.

The solid polymer compound may be a fluoro polymer compound containing C-F bonds in the polymer chains or a hydrocarbon type polymer compound containing only the C-H bonds in the polymer chains. Further, the fluoro compounds may be either those having both C-F bonds and C-H bonds in the polymer chains (hereinafter referred to as "fluoro-hydrocarbon type polymer compound"), or those containing C-F bonds and not containing C-H bonds in the polymer chains (hereinafter referred to as "perfluoro polymer compound"). The fluoro polymer compound may also contain, in addition to the C-F bonds, C-Cl bonds and other bonds (for example, -O-, -S-, -C(=O)-, -N(R)-, etc.).

Further, the hydrocarbon type polymer compounds may be either those not having aromatic rings in the polymer chains (hereinafter referred to as "aliphatic hydrocarbon type polymer compound"), or those having aromatic rings in any of the polymer chains (hereinafter referred to as "aromatic hydrocarbon type polymer compound"). Further, the aromatic hydrocarbon type polymer compounds may be either those having an alkylene chain ($-(CH_2)_n-$, $n \geq 1$) or a branched carbon structure (for example, $-CHCH_3-$, $-C(CH_3)_2-$, etc.) in part of the bonding chains (such a compound will hereinafter be referred to as "partial aromatic hydrocarbon type polymer

compound"), or those not containing an alkylene chain or a branched carbon structure in the bonding chains (such a compound will hereinafter be referred to as "whole aromatic hydrocarbon type polymer compound").

Among them, the fluoro polymer compound is excellent in heat resistance and oxidation resistance since they have C-F bonds. Further, as will be described later, the intermediate acid group functions as a strong acid group by the interaction with the perfluoro skeleton. Therefore, for obtaining a modified electrolyte having heat resistance, oxidation resistance, and high electric conductivity, it is preferred to use a fluoro polymer compound, particularly, a perfluoro polymer compound as the solid polymer compound.

Further, among the hydrocarbon type polymer compounds, in the aromatic hydrocarbon type polymer compound, side chains having the acid groups can be introduced relatively easily. Therefore, for obtaining a modified electrolyte having high electric conductivity, it is preferred to use an aromatic hydrocarbon type polymer compound, particularly, a whole aromatic hydrocarbon type polymer compound as the solid polymer compound.

The modified electrolyte according to this embodiment has a feature in that plural acid groups are introduced into one side chain constituting the solid polymer compound. Therefore, high electric conductivity can be obtained even if the number of side chains bonded to the main chain is relatively small. Further, the total amount of acid groups that can be

introduced into the entire electrolyte increases with the number of side chains bonded to the main chain.

Then, the terminal acid group is to be explained. The terminal acid group is an acid group bonded to the terminal end of the side chain. The terminal acid group may be bonded to the terminal end(s) of a portion of the side chains, or may be bonded to the terminal ends of all of the side chains constituting the solid polymer compound. In a case where the side chain has a branch structure, the terminal acid group may be bonded to the terminal end of one of the branched chains, or may be bonded to the terminal ends of a plurality of the branched chains. Generally, the electrolyte shows higher electric conductivity as the number of side chains to which the terminal acid groups are bonded and/or the number of terminal acid groups bonded to the side chains are/is larger.

Specifically, the terminal acid group may preferably include, a sulfonic acid group, a carboxylic acid group, and a phosphonic acid group. In a case where plural terminal acid groups are bonded to one side chain, all of such terminal acid groups may be identical with one another, or different kinds of terminal acid group may be combined. Further, the kind of terminal acid group may vary from one side chain to another.

Then, the intermediate acid group and the modified acid group are to be explained. The intermediate acid group is an acid group that constitutes a portion of the bonding chain in the side chain. Further, the modified acid group is an acid group in which a portion of elements constituting the

intermediate acid group is substituted with at least one atom group having an acid group. In this case, there is no particular restriction on the acid group in the atom group; it may have the structure identical with that of the terminal acid group, the intermediate acid group, or the modified acid group described above. Further, the atom group may have either a linear or branch structure, and may further be either a fluoro or hydrocarbon type.

Further, this embodiment has a feature that at least a portion of the intermediate acid groups or the modified acid groups is present in the side chain identical with the side chain in which at least one terminal acid group is present. In this case, a portion of the side chains constituting the solid polymer compound may be side chains having both of the terminal acid group and the intermediate acid group or the modified acid group (hereinafter referred to as "multifunctional side chain") or all of the side chains may be multifunctional side chains.

Further, the multifunctional side chain may have one intermediate acid group or modified acid group, or may have a plurality of intermediate acid groups and/or modified acid groups. Generally, the electrolyte shows higher electric conductivity as the number of multifunctional side chains and/or the number of terminal acid groups, intermediate acid groups, or modified acid groups bonded to the multifunctional side chains are/is larger. Further, a modified electrolyte having an electric conductivity of 0.05 S/cm or more can be

obtained by properly controlling the kind of terminal acid group, intermediate acid group, and modified acid group, as well as the amount of those acid groups to be introduced into the solid polymer compound.

Further, in a case where a plurality of intermediate acid groups and/or modified acid groups are bonded to one multifunctional side chain, all of the acid groups may be of one kind, or different kinds of acid group may be combined. Further, the kind of intermediate acid group and/or modified acid group may vary from one multifunctional side chain to another.

The intermediate acid group may preferably include, a bissulfonyl imide group ($-\text{SO}_2-\text{NH}-\text{SO}_2-$), a sulfonyl carbonyl imide group ($-\text{CO}-\text{NH}-\text{SO}_2-$), and a biscarbonyl imide group ($-\text{CO}-\text{NH}-\text{CO}-$). The modified acid group may preferably include, those in which hydrogen of the bissulfonyl imide group, sulfonyl carbonyl imide group, or biscarbonyl imide group is substituted on a perfluoroalkylene chain having sulfonic acid groups, and the like.

In a case where the intermediate acid group is the bissulfonyl imide group, the sulfonyl carbonyl imide group, or the biscarbonyl imide group described above, it functions as the acid group even if the both ends thereof are bonded to the hydrocarbon skeleton. However, in a case where one end or both ends of the intermediate acid group are bonded to the perfluoro skeleton, the intermediate acid group functions as a strong acid group to provide the modified electrolyte with

high electric conductivity. This is because electrons that contribute to N-H bonds move toward the perfluoro skeleton, being attracted by F having large electro-negativity, whereby H bonded to N becomes prone to be released as a proton.

A process for producing a modified electrolyte according to this embodiment is to be explained. The modified electrolyte according to this embodiment can be obtained by reacting a solid polymer compound having a functional group A with a modifying agent.

The solid polymer compounds may be either those having the functional groups A, or those to which the functional groups A can be introduced. Accordingly, the solid polymer compound before reaction may be of a linear or branch structure. Further, the solid polymer compound may be either a fluoro type polymer compound or a hydrocarbon type polymer compound.

Among them, for obtaining a modified electrolyte having high electric conductivity, the solid polymer compound is preferably an aromatic hydrocarbon type polymer compound, and particularly, a whole aromatic hydrocarbon type polymer compound. Further, for obtaining a modified electrolyte having heat resistance, oxidation resistance and high electric conductivity, the solid polymer compound is preferably a fluoro polymer compound, and particularly, a perfluoro polymer compound.

The functional group A is a functional group that can be a first intermediate acid group by reacting with a functional group B of the modifying agent described later. The functional

group A may be introduced to any site of the solid polymer compound. That is, the functional group A may be bonded directly to the linear solid polymer compound, or may be bonded to the intermediate portion or terminal end of the side chain constituting the solid polymer compound.

The functional group A may preferably include, a sulfonyl halide group, a sulfonamide group, sulfonamide metallic salt, an N-alkylsilylsulfonamide group, N-alkylsilylsulfonamide metallic salt, a carbonyl halide group, a carboxylate ester group, a carbonylamide group, a phosphonyl halide group, a phosphate ester group, a phosphonylamide group, a sulfonic acid group, a carboxylic acid group, a phosphonic acid group, and derivatives thereof. Particularly, the sulfonyl halide group and the derivative thereof are suitable as the functional group A, because they can be easily hydrolyzed into strong acid groups and provide the modified electrolyte with high electric conductivity even when they are not consumed in the reaction with the modifying agent.

As the functional group A, it is preferred to use a sulfonamide group obtained by reaction between a sulfonyl halide group and ammonia. In this case, the reaction ratio between the sulfonyl halide group and ammonia is preferably 20 to 100 %. The reaction ratio is more preferably 30 to 100 %, further preferably 50 to 100 %, and particularly preferably 70 to 100 %.

The solid polymer compound may contain a single kind of functional group A, or may contain plural kinds of functional

group A. Further, a single kind of solid polymer compound having at least one kind of functional group A may be reacted with a modifying agent, or plural kinds of solid polymer compounds each having the identical or different functional groups A may be mixed at an arbitrary ratio, and may be reacted with the modifying agent.

The perfluoro polymer compound having the functional group A may preferably include, Nafion (registered trade mark) manufactured by E.I. duPont de Nemours and Company, Aciplex (registered trade mark) manufactured by Asahi Kasei Corp., Flemion (registered trade mark) manufactured by Asahi Glass Co. Ltd., GORE-TEX® (registered trade mark) membranes manufactured by W.L.Gore & Associates, and derivatives thereof.

The fluoro-hydrocarbon type polymer compound to which the functional group A can be introduced may preferably include, polystyrene-grafted-ethylene tetrafluoroethylene copolymer (hereinafter referred to as " ETFE-g-PS"), polytetrafluoroethylene-grafted-polystyrene, and derivatives thereof.

The aliphatic hydrocarbon type polymer compound to which the functional group A can be introduced may preferably include, polyamide, polyacetal, polyethylene, polypropylene, acrylic resin, polyester, polysulfone, polyether, and derivatives thereof.

The partial aromatic hydrocarbon type polymer compound to which the functional group A can be introduced may preferably

include polystyrene, polyamide, polyamide imide, polyimide, polyester, polysulfone, polyether imide, polyether sulfone, and polycarbonate having aromatic rings, as well as derivatives thereof.

The whole aromatic hydrocarbon type polymer compound to which the functional group A can be introduced may preferably include polyether ether ketone, polyether ketone, polysulfone, polyether sulfone, polyimide, polyether imide, polyphenylene, polyphenylene ether, polycarbonate, polyamide, polyamide imide, polyester, polyphenylene sulfide, and derivatives thereof.

Further, the compound which has the functional group A or to which the functional group A has been introduced (electrolyte) may be reinforced with a reinforcing material such as a porous polytetrafluoroethylene (PTFE) sheet, or fibril PTFE fibers.

There is no particular restriction on the concentration of the functional group A and the number of side chains having the functional group A in the solid polymer compound used as the starting material, and a compound having the optimum concentration or number of side chains may be used in accordance with the strength, the electric conductivity, and the like required for the modified electrolyte. Generally, the total amount of acid groups that can be introduced into the entire electrolyte increases as the concentration of the functional group A is higher, or as the number of side chains having the functional group A is larger. Accordingly, for obtaining a

modified electrolyte showing high electric conductivity, higher concentration of the functional group A is preferred so long as the crystallinity of the main chain structure is not deteriorated, and it is also preferred that the number of side chains having the functional group A is larger.

Specifically, the concentration of the functional group A is preferably 0.25 mmol/g or more and 10 mmol/g or less, and further preferably 0.5 mmol/g or more and 4 mmol/g or less.

Then, the modifying agent is to be explained. The modifying agent for introducing the intermediate acid group to the side chains of the solid polymer compound (hereinafter referred to as "first modifying agent") should have at least one functional group B and at least one functional group C in one molecule.

The functional group B is a functional group capable of reacting with the functional group A in the solid polymer compound, thereby forming a first intermediate acid group. The functional group may preferably include, a sulfonyl halide group, a sulfonamide group, sulfonamide metallic salt, an N-alkylsilylsulfonamide group, N-alkylsilylsulfonamide metallic salt, a carbonyl halide group, a carboxylate ester group, a carbonylamide group, a phosphonyl halide group, a phosphate ester group, a phosphonylamide group, a sulfonic acid group, a carboxylic acid group, a phosphonic acid group, and derivatives thereof.

Particularly, the sulfonyl halide group, the carbonyl halide group, the phosphonyl halide group, the sulfonate ester

group, the carboxylate ester group, and the phosphate ester group are suitable as the functional group B.

The functional group C is a functional group capable of forming a terminal acid group or a second intermediate acid group. The functional group C includes a terminal acid group or a second intermediate acid group per se, as well as those forming the terminal acid group or the second intermediate acid group by hydrolysis, substitution reaction, or the like. The functional group C may preferably include, halogen, a sulfonyl halide group, a sulfonamide group, sulfonamide metallic salt, an N-alkylsilylsulfonamide group, N-alkylsilylsulfonamide metallic salt, a carbonyl halide group, a carboxylate ester group, a carbonylamide group, a phosphonyl halide group, a phosphate ester group, a phosphonylamide group, and derivatives thereof.

The first modifying agent having the functional groups B and C described above may preferably include, fluorosulfonyl fluoride such as: 1,1,2,2-tetrafluoroethyl-1,3-disulfonyl fluoride; 1,1,2,2,3,3-hexafluoropropyl-1,3-disulfonyl fluoride; 1,1,2,2,3,3,4,4-octafluorobutyl-1,4-disulfonyl fluoride; 1,1,2,2,3,3,4,4,5,5-perfluorobutyl-1,5-disulfonyl fluoride, or derivatives thereof.

Further, as the first modifying agent, it may also be possible to use fluorosulfonyl chloride such as: 1,1,2,2-tetrafluoroethyl-1,2-disulfonyl chloride; 1,1,2,2,3,3-hexafluoropropyl-1,3-disulfonyl chloride; 1,1,2,2,3,3,4,4-octafluorobutyl-1,4-disulfonyl chloride;

1,1,2,2,3,3,4,4,5,5-perfluorobutyl-1,5-disulfonyl chloride; and derivatives thereof, as well as 1,4-benzene disulfonyl chloride and 4,4'-biphenyldisulfonyl chloride.

Further, other specific examples of the first modifying agent may include preferably, 1,1,2,2,3,3-hexafluoropropyl-3-iodo-1-sulfonyl fluoride, 1,1,2,2,3,3,4,4-octafluorobutyl-4-iodo-1-sulfonyl fluoride, and derivatives thereof.

The modifying agent for introducing the modified acid group to the side chain of the solid polymer compound (hereinafter referred to as "second modifying agent") should have at least one functional group D and at least one functional group E.

The functional group D is a functional group capable of reacting with the first or the second intermediate acid group introduced to the side chain. The functional group D may preferably include, halide, a sulfonyl halide group, a carbonyl halide group, a phosphonyl halide group, and derivatives thereof.

Further, the functional group E is a group capable of forming a terminal acid group or a third intermediate acid group. That is, the functional group E includes a terminal acid group or a third intermediate acid group per se, as well as those forming the terminal acid group or the third intermediate acid group by hydrolysis, substitution reaction, or the like. The functional group E may preferably include, a sulfonyl halide group, a carbonyl halide group, a carboxylate ester group, a

bissulfonyl imide group, a sulfonylcarbonyl imide group, a biscarbonyl imide group, halogen, and derivatives thereof.

The second modifying agent having the functional group D and the functional group E may preferably include:

1,1,2,2,3,3-hexafluoro-1,3-diiodide; 1,1,2,2,3,3,4,4-octafluoro-1,4-diiodide; and derivatives thereof.

In a case where the fluoro sulfonyl halide is used as the first modifying agent, the number of carbon atoms in the sulfonyl halide group is preferably 1 to 20. The fluoro sulfonyl halide may have a linear structure or a branch structure. Further, for providing the modified electrolyte with high electric conductivity, those having a branch structure and also having plural sulfonyl halide groups are particularly suitable.

Further, the first modifying agent may contain one kind of functional groups B and C each described above, or may contain plural kinds of functional groups B and C each. Further, a single kind of compound having at least one kind of functional groups B and C may be used as the first modifying agent, or plural kinds of compounds each having the identical or different functional groups B and C may be mixed at an arbitrary ratio and used as the first modifying agent. The same holds true with the second modifying agent.

A modified electrolyte having multifunctional side chains is obtained when the solid polymer compound having the functional group A are reacted with the first modifying agent and/or the second modifying agent under an optimal condition

in accordance with a combination thereof after a pre-treatment has been applied to them as needed. Particularly, a modified electrolyte showing high electric conductivity is obtained by amidating the functional group A of the solid polymer compound, and then, by reacting the same with the modifying agent under the optimal condition.

In this case, the introduced amount of the first modifying agent and the second modifying agent, and the reaction ratios between these agents and the solid polymer compound may be selected in accordance with the electric conductivity and the mechanical characteristic required for the modified electrolyte. Generally, a modified electrolyte having higher electric conductivity is obtained as the percentage of the functional group A reacted with the modifying agent is increased.

Specifically, it is preferred to introduce a first modifying agent having at least one functional group B and at least one functional group C to a solid polymer compound having a functional group A, and then, to react 20 % to 100 % of the functional group A with the functional group B. The reaction ratio of the functional group A is further preferably 30 to 100 %, more preferably 50 to 100 %, and particularly preferably 70 to 100 %.

Further, when a second modifying agent is further reacted with the reaction product between the solid polymer compound having the functional group A and the first modifying agent, the introduced amount of acid groups increases in

accordance with the reaction ratio, further improving the electric conductivity.

For example, as shown in Fig. 1, when a perfluoro polymer compound 10 having a sulfonyl fluoride group (functional group A) at the terminal end of a side chain 12 is reacted with a linear modifying agent having a predetermined functional group on both of its terminal ends (not illustrated) under an appropriate condition, a portion of the side chain 12 is modified into multifunctional side chains 22 and 24 to form a modified electrolyte 20.

Among them, the multifunctional side chain 22 is formed by the modification of the portion of the side chain 12 with the first modifying agent, and has two acid groups which are a sulfonic acid group (terminal acid group) and a bissulfonyl imide group (intermediate acid group). Further, the multifunctional side chain 24 is formed by further modification of the multifunctional side chain 22 with a second modifying agent, and has two acid groups which are a sulfonic acid group being the terminal acid group and a modified acid group in which hydrogen of the bissulfonyl imide group has been substituted with an atom group having a sulfonic acid group.

Then, the function of the modified electrolyte according to this embodiment is to be explained. The solid polymer electrolyte generally comprises a main chain that contributes to the strength and side chains having electrolyte groups. The electrolyte groups on the side chains are associated to form a cluster, and are joined by way of a narrow

channel to form a conduction path. Accordingly, a thick conductive path has to be formed for enhancing the electric conductivity of the solid polymer electrolyte. To this end, it is necessary to increase the concentration of the electrolyte groups in the solid polymer electrolyte.

On the other hand, existent perfluoro polymer electrolyte typically represented by Nafion generally comprises a copolymer of a monomer having one electrolyte group (hereinafter referred to as "electrolyte group monomer") and a monomer constituting a main chain. Accordingly, for increasing the concentration of the electrolyte groups contained in the perfluoro polymer electrolyte, it is necessary to increase the ratio of the electrolyte group monomers upon synthesis. However, when the ratio of the electrolyte group monomers increases, crystallinity of the main chain is lowered and the strength can no more be maintained, whereas the electric conductivity is increased.

On the contrary, as shown in Fig. 2A, when a solid polymer compound having one functional group A in the side chain is reacted with a linear modifying agent, a modified electrolyte 20a having a multifunctional side chain 22a containing a terminal acid group (sulfonic acid group) and an intermediate acid group (indicated as "S" in Figs. 2A to 2F) is obtained. In the same manner, when the solid polymer compound and a branched modifying agent having three functional groups are reacted, an electrolyte 20b having a multifunctional side chain 22b containing two terminal acid groups and one intermediate

acid group is obtained as shown in Fig. 2B. Further, when the solid polymer compound is reacted with a modifying agent having plural branches, or reacted with a modifying agent by several times repeatedly, a modified electrolyte 20c having a multifunctional side chain 22c containing a plurality of terminal acid groups, intermediate acid groups, and modified acid groups (indicated as " S' " in Figs. 2A to 2F, meaning the intermediate acid groups which have been deprived of -hydrogen) is obtained.

Schematic cross sectional views for the modified electrolytes 20a to 20c obtained in this way are shown, in Fig. 2D to Fig. 2F, respectively. Since the conduction paths 30a to 30c is thickened by the increase of the amount of acid groups, the modified electrolytes 20a to 20c show higher electric conductivity before modification. In addition, since the conduction paths 30a to 30c are thickened as the amount of acid groups introduced into the side chain increases, the electric conductivity also increases correspondingly.

On the other hand, in the modified electrolytes 20a to 20c, there is no structural change in the main chain skeletons 32a to 32c that contributes to the strength upon modification. Accordingly, the modified electrolytes 20a to 20c maintain identical strength with that before modification and are not markedly swollen or solubilized in water even if the amount of acid groups introduced to the side chain increases.

Further, when an electrolyte is synthesized by using monomers having plural acid groups in the ether moiety, there

is a concern that insufficient molecular weight may be obtained because of the bulkiness of the monomer, and that the membrane strength may be insufficient. Further, since monomer of higher bulkiness is less copolymerized, there is a limit for the number of side chains (that is, the number of acid groups) introduced to per-molecule basis. On the contrary, since the modified electrolyte according to this embodiment can be produced by reacting the functional group A of the solid polymer compound and the modifying agent, the control range for the number of side chains per molecule and the number of acid groups per side chain is large. Therefore, a modified electrolyte having higher strength and higher electric conductivity not obtainable by the existent process can be obtained.

Then, a modified electrolyte and a process for producing the modified electrolyte according to a third embodiment of the present invention are to be explained. The modified electrolyte according to this embodiment comprises polymer compounds having side chains, at least one terminal acid group present at the terminal ends of the side chains, at least one intermediate acid group and/or modified acid group within the side chain identical with the side chain in which the terminal acid group is present. It further comprises a crosslinking group that crosslinks the solid polymer compounds to each other.

In this embodiment, the solid polymer compound may be crosslinked on either the main chain or the side chain. Generally, there are various methods for crosslinking polymer

compounds, and crosslinking groups take various structures in accordance with the crosslinking method to be used. In this embodiment, the solid polymer compound may be crosslinked by any of the methods, and the structure of the crosslinking group has no particular restriction.

However, since the terminal acid group has higher reactivity compared with other portions, it is preferred to crosslink the solid polymer compound by way of the terminal acid group. Further, in the case of crosslinking using the terminal acid group, two terminal acid groups are consumed on every introduction of one crosslink structure into the solid polymer compound. Accordingly, for obtaining a modified electrolyte showing high electric conductivity, the solid polymer compound is preferably crosslinked by way of an acidic crosslinking group.

The acidic crosslinking group is a crosslinking group that exhibits acidity in a state of containing water. For this purpose, it is necessary that the acidic crosslinking group have a structure capable of moving electrons easily from the crosslinked point. Specifically, such includes preferably, for example, a bissulfonyl imide group, a sulfonyl carbonyl imide group and a biscarbonyl imide group. The solid polymer compound may be crosslinked by way of one kind of acidic crosslinking group or may be crosslinked by way of plural kinds of acidic crosslinking group, among them.

Generally, a modified electrolyte with excellent heat resistance is obtained as the crosslinking density increases.

However, when the crosslinking density is excessive, it hinders containment of water and movement of molecules of water, rather it tends to deteriorate the proton conductivity. Accordingly, the crosslinking density may be selected to an optimal value in accordance with the heat resistance, the electric conductivity, and the like required for the modified electrolyte. The crosslinking density can be controlled specifically by adjusting the water content in the reaction solution. Generally, as the amount of water in the reaction solution increases, the crosslinking density is lowered, and the crosslinking density increases by reducing the water content as much as possible.

Further, the acidic crosslinking group and the intermediate acid group described above are alike in showing a strong acidity in the case where the group is bonded at one end or both ends to the perfluoro skeleton. Further, since the constitutions of the solid polymer compound, the terminal acid group, the intermediate acid group and the modified acid group are identical with those in the second embodiment, explanations therefor are to be omitted.

The modified electrolyte according to this embodiment can be produced by using various methods. Among them, the modified electrolyte crosslinked by way of the acidic crosslinking group can be produced by reacting the solid polymer compound having the functional group A described above and the first modifying agent described above having plural functional groups B.

10079873-022002

After applying a pretreatment as necessary to the solid polymer compound and the modifying agent described above, when they are reacted under an optimal condition in accordance with the combination thereof, one functional group B is reacted with one functional group A, whereby a portion of the modifying agent becomes part of the multifunctional side chain. Further, each of at least two functional groups B are reacted with the functional groups A of different solid polymer compounds, whereby other modifying agents becomes part of a crosslink structure linking the solid polymer compounds to each other. In addition, the crosslinked point forms an acidic crosslinking group formed by reaction between the functional group A and the functional group B. In this case, the ratio of forming the multifunctional side chain and the acidic crosslinking group can be controlled by optimizing the reaction conditions.

For obtaining a modified electrolyte showing high strength and high electric conductivity, it is desirable that a modifying agent having plural functional groups B be introduced to a solid polymer compound having a functional group A and that 20 % to 100 % of the functional group A be reacted with the functional groups B. The reaction ratio of the functional group A is preferably from 30 to 100 %, more preferably from 50 to 100 %, and particularly preferably from 70 to 100 %.

Since the modified electrolyte according to this embodiment has multifunctional side chains, it shows high strength and high electric conductivity. Further, since it

has a crosslink structure linking the solid polymer compounds to each other, the flow of molecules at high temperatures is suppressed, and the high temperature creep resistance is remarkably improved. Particularly, when the solid polymer compounds are crosslinked by way of acidic crosslinking groups, since the terminal acid groups consumed by the crosslinking reaction are compensated with the acidic crosslinking groups, a modified electrolyte excellent in the strength, electric conductivity and high temperature creep resistance can be obtained.

Further, a modified electrolyte having an electric conductivity of 0.05 S/cm or more, and a creep elongation of 150 % or less (test temperature: 160 °C, stress added: 0.8 MPa, test time: 4 minutes) is obtained by controlling the concentration of the functional group A, the reaction ratio of the functional group A, the kinds of functional groups A and B, and the production conditions.

Further, since the modified electrolyte according to the present invention can be formed in a non-crosslinked state into a membrane and the like and then introduced with the crosslink structure, the molding is facilitated more easily compared with a method of introducing the crosslink structure upon polymerization. Further, even in the case of using a solid polymer compound which has a relatively high concentration of electrolyte groups (or having a relatively large number of side chains) and which is easily swelled or soluble in water as the starting material, the modified

electrolyte can be insolubilized in water by introducing the crosslink structure. Accordingly, the degree of design freedom for the electrolyte can be improved remarkably, and various modified electrolytes with different heat resistance, strength and electric conductivity can be obtained.

[Example]

(Example 1)

At first, an amine treatment of contacting an amine compound with a perfluoro polymer electrolyte was conducted in accordance with the following procedures. That is, a Nafion 112F membrane (F112: the precursor of Nafion with sulfonyl fluoride group) of 50 μm thickness and sized 1 cm x 8 cm was immersed for 5 minutes in 80 ml of a flon solvent (R113) in a globe box. Then, 5 ml of a 1.0 M (mol/L) THF solution of lithium bis(trimethylsilyl)amide (hereinafter referred to as LBTMSA) as an amine compound was added under stirring to the flon solvent, and they were immersed for 15 minutes. Subsequently, the membrane was taken out and washed with R113 and THF solutions.

Subsequent procedures were conducted in air at a room temperature. At first, the obtained membrane was put in a 25 % aqueous solution of sodium hydroxide, refluxed for 2 hours, and washed with water. Then, it was hydrolyzed being immersed in 6 M hydrochloric acid for 5 hours, and remaining sulfonyl chloride groups were converted into sodium sulfonate groups. Further, the membrane was immersed in 1 M sulfuric acid, refluxed for one hour, and then converted into proton type.

The resultant membrane was immersed in purified water for 10 minutes, to be refluxed, washed with water, and then stored in purified water. The electrolyte membrane is referred to as Example 1.

Then, the electric conductivity of the electrolyte membrane of Example 1 thus obtained was measured by the following procedures. That is, an obtained electrolyte membrane of 1 cm width was attached to a two-terminal electric conductivity measuring cell. A platinum foil applied with platinum black plating was used for current and voltage terminals of the cell for improving the contact with the membrane.

Then, each cell was immersed in purified water, and the membrane resistance of the electrolyte membrane was measured by an AC method (10 kHz) using an LCR meter (4262A LCR METER, manufactured by YHP). The electric conductivity (σ) was determined in accordance with the following formula 1. The value for the thickness of each membrane was measured by micrometer after measuring the electric conductivity.

[Expression 1]

$$\sigma = L / (R \cdot A) = L / (R \cdot w \cdot t)$$

where,

σ : electric conductivity (S/cm)

R : membrane resistance (Ω)

L : distance between voltage terminals (= 1 cm)

A : membrane cross sectional area (cm²)

t : membrane thickness (cm)

w : membrane width (cm)

Then, a creep resistance test at 160 °C for electrolyte membrane of Example 1 was conducted by the following procedures. That is, a weight was suspended from a membrane so as to apply a load of 0.8 MPa, the membrane was exposed to an atmosphere at 160 °C and the ratio of the elongation of membrane to the initial length after 1 minute (creep elongation) was measured. (Examples 2 to 4)

Each of the membranes was treated in accordance with the same procedures as those in Example 1 except for changing the immersion time in the LBTMSA solution to 30 minutes, 1 hour and 2 hours. The electrolyte membranes are referred to as Example 2, Example 3 and Example 4, respectively. Further, measurement of the electric conductivity and evaluation of the creep resistance were conducted in the same manner as those in Example 1.

(Example 5)

5 ml of a 0.1 M (mol/L) THF solution of LBTMSA was added under stirring to 80 ml of a flon solvent (R113) in which a Nafion membrane (F112) was immersed, and the membrane was immersed for 15 minutes. Then, the membrane was taken out and washed with R113 and THF solutions. Successively, a heat treatment was conducted by heating the membrane at 120 °C for 12 hours under a reduced pressure by a rotary pump. Subsequently, the membrane was treated in the same procedures as those in Example 1. The electrolyte membrane is referred to as Example 5. Further, measurement of the electric

conductivity and evaluation of the creep resistance were conducted in the same manner as those in Example 1.

(Examples 6, 7)

Each of the membranes was treated in accordance with the same procedures as those in Example 5 except for changing the immersion time in the LBTMSA solution to 1 hour and 2 hours. The electrolyte membranes are referred to as Example 6 and Example 7, respectively. Further, measurement of the electric conductivity and evaluation of the creep resistance were conducted in the same manner as those in Example 1.

(Comparative Example 1)

For the Nafion membrane (F112), hydrolysis, proton exchange, and storage in purified water of the membrane were conducted in accordance with the same procedures as those in Example 1 except for conducting none of the amine treatment, base treatment and heat treatment. The electrolyte membrane is referred to as Comparative Example 1. Further, electric conductivity was measured in the same manner as in Example 1, and creep elongation for 8 minutes was also measured as evaluation for the creep resistance.

Table 1 shows the treatment conditions and the result of measurement of various characteristics of electrolyte membranes obtained in Examples 1 to 7 and Comparative Example 1.

[Table 1]

Sample	LBTMSA Addition Amount (ml)	LBTMSA Treatment Time	Heat Treatment Condition	Electric Conductivity (S/cm)	Creep Elongation after 1 minute (%)
Example 1	5	15 minutes	—	6.0×10^{-2}	126
Example 2	5	30 minutes	—	6.2×10^{-2}	68
Example 3	5	1 hour	—	2.1×10^{-2}	8.7
Example 4	5	2 hours	—	1.7×10^{-2}	4.4
Example 5	5	15 minutes	120°C 12 hours	6.6×10^{-2}	21
Example 6	5	1 hour	120°C 12 hours	1.9×10^{-3}	9.8
Example 7	5	2 hours	120°C 12 hours	2.4×10^{-3}	2
Comparative Example 1	—	—	—	7.14×10^{-2}	121

Examples 1 to 4 applied only with the amine treatment by LBTMSA showed a behavior that creep elongation in one minute abruptly decreased along with an increase in the amine treatment time, which was settled substantially constant after one hour. Further, in Examples 2 to 4, the creep elongation was about 1/2 or less of Comparative Example 1, and creep resistance was improved.

On the other hand, in Examples 1, 2 in which the amine treatment time was 30 minutes or less, the electric conductivity was not lowered so much compared with Comparative Example 1. However, in Examples, 3, 4 in which the amine treatment time was 1 hour or more, the ratio of decrease in the electric conductivity was increased. From the results, it can be seen that there is less effect on an improvement in the creep resistant property when the amine treatment time is

excessively short. On the other hand, it can be understood that the creep resistance property is improved, but the electric conductivity is lowered when the amine treatment time is excessively long. That is, it can be seen that the amine treatment time has to be selected within such a range as not to greatly lower the electric conductivity and as to improve the creep resistant property.

In Example 5 in which the amine treatment and the heat treatment were conducted for 15 minutes, the creep elongation was 21 % which was greatly reduced compared with Example 1 in which only the amine treatment for 15 minutes was conducted. However, in Examples 6 and 7 in which the amine treatment for one hour or more and the heat treatment were conducted, the creep elongation was substantially identical with that in Examples 3 and 4 in which only the amine treatment was conducted for the identical time. That is, it can be seen that the creep elongation can be remarkably reduced when the heat treatment is conducted after the amine treatment even when the amine treatment time is relatively short.

On the other hand, electric conductivity in Examples 5, 6 and 7 are substantially identical with that in Examples 1, 3 and 4 in which only the amine treatment was conducted for the identical time, and the electric conductivity did not change remarkably depending on the absence or presence of the heat treatment.

The reason why the creep resistant property is greatly improved by conducting the amine treatment as described above

is not apparent specifically, but it may be considered that either covalent or ionic crosslinking caused by the amine compound is formed in the portion of the electrolyte group or the electrolyte group precursor in the perfluoro polymer electrolyte.

That is, it may be considered that the perfluoro polymers are crosslinked to each other mainly in the state of ionic bonds in the case of conducting only the amine treatment. Further, it may be considered that the creep elongation is decreased, and the electric conductivity is lowered as the amine treatment time is longer, because more electrolyte groups or the electrolyte group precursors are consumed by the crosslinking reaction to increase the crosslinked point.

Further, it may be considered that the creep elongation is decreased by the heat treatment conducted after the amine treatment has been conducted for a short time because the heating causes covalent crosslinking between the perfluoro polymer electrolyte and the amine compound. Further, it may be considered that the electric conductivity is maintained high even after the heat treatment, because the number of electrolyte groups or the electrolyte group precursors consumed newly by heating in the crosslinking reaction is relatively small.

(Examples 8 to 11)

Each of the membranes was treated in accordance with the same procedures as those in Example 5 except for changing the addition amount of the LBTMSA solution to 2.5 ml, 1.25 ml,

0.6 ml and 0.3 ml, respectively, and the immersion time to 30 minutes. Such electrolyte membranes are referred to as Example 8, Example 9, Example 10 and Example 11, respectively. Further, the electric conductivity was measured, and the creep resistance was evaluated in the same manner as in Example 1. (Examples 12 to 15)

Each of the membranes was treated in accordance with the same procedures as those in Example 5 except for changing the addition amount of the LBTMSA solution to 2.5 ml, 1.25 ml, 0.6 ml and 0.3 ml, respectively, and the immersion time to 1 hour. Such electrolyte membranes are referred to as Example 12, Example 13, Example 14 and Example 15, respectively. Further, the electric conductivity was measured, and the creep resistance was evaluated in the same manner as in Example 1.

Table 2 shows the treatment conditions and the result of measurement of various characteristics of electrolyte membranes obtained in Examples 8 to 15 and Comparative Example 1.

[Table 2]

Sample	LBTMSA Addition Amount (ml)	LBTMSA Treatment Time	Heat Treatment Condition	Electric Conductivity (S/cm)	Creep Elongation after 1 minute (%)
Example 8	2.5	30 minutes	120°C 12 hours	6.3×10^{-2}	33
Example 9	1.25	30 minutes	120°C 12 hours	7.1×10^{-2}	63
Example 10	0.6	30 minutes	120°C 12 hours	7.2×10^{-2}	66
Example 11	0.3	30 minutes	120°C 12 hours	8.2×10^{-2}	50
Example 12	2.5	1 hour	120°C 12 hours	4.2×10^{-2}	9.8
Example 13	1.25	1 hour	120°C 12 hours	6.7×10^{-2}	29
Example 14	0.6	1 hour	120°C 12 hours	7.9×10^{-2}	60
Example 15	0.3	1 hour	120°C 12 hours	6.4×10^{-2}	59
Comparative Example 1	—	—	—	7.14×10^{-2}	121

In Examples 8 to 11 in which the amine treatment time was 30 minutes, the creep elongation was about 1/3 to 1/2 of Comparative Example 1 in any of the cases, and the creep resistant property was improved remarkably in each of the cases. Further, the electric conductivity increased as the addition amount of the amine compound decreased. Particularly, in Example 11, both the electric conductivity and the creep resistant property were improved remarkably compared with Comparative Example 1.

Also in Examples 12 to 15 in which the amine treatment time was 1 hour, and the addition amount of the amine compound was changed in the same manner as in Examples 8 to 11, similar trend to that in Examples 8 to 11 was observed. However, in Example 12 in which the addition amount of the amine compound was greatest, creep elongation for one minute was remarkably

smaller compared with Comparative Example 1, but the electric conductivity was lowered compared with Example 8.

From the foregoing, it can be seen that both the property of the creep resistance and the electric conductivity are improved as the addition amount of the amine compound is smaller and/or the amine treatment time is shorter in the case where the condition of the heat treatment conducted after the amine treatment step is constant.

(Example 16)

A 5 ml 1,4-dioxane solution including 1.0 M (mol/L) of ammonia as an amine compound was added to 80 ml of a flon solvent (R113) in which a Nafion membrane (F112) was immersed, and then the membrane was immersed for two days. Then, the membrane was taken out and washed with R113 and THF solutions. Successively, the membrane received heat treatment conducted by heating at 120 °C for 3 days under a reduced pressure by a rotary pump. Subsequently, the membrane was treated in accordance with the same procedures as those in Example 1. The electrolyte membrane is referred to as Example 16. Further, the electric conductivity was measured in the same manner as in Example 1 and creep elongation for 8 minutes was also measured for the evaluation of creep resistance.

(Examples 17 to 19)

Each of the membranes was treated in accordance with the same procedures as those in Example 16 except for changing the immersion time in the ammonia solution to 5 days, 7 days and 10 days. The electrolyte membranes are referred to as

Example 17, Example 18 and Example 19, respectively. Further, the electric conductivity was measured, and the creep resistance was evaluated in the same manner as in Example 16. (Example 20)

The membrane was treated in accordance with the same procedures as those in Example 16 except for changing the heat treatment time to 2 hours. The membrane was referred to as Example 20. Further, the electric conductivity was measured, and the creep resistance was evaluated in the same manner as in Example 16.

(Example 21)

The membrane was treated in accordance with the same procedures as those in Example 16 except for not conducting the heat treatment. The membrane was referred to as Example 21. Further, the electric conductivity was measured, and the creep resistance was evaluated in the same manner as in Example 16.

(Example 22)

A 5 ml 1,4-dioxane solution including 1.0 M (mol/L) of ammonia was added to 80 ml of a flon solvent (R113) in which a Nafion membrane (F112) was immersed, and the membrane was immersed for two days. Then, the membrane was taken out and washed with R113 and THF solutions.

Then, the membrane received a base treatment of heating at 100 °C for 5 hours in an R113 solution of 10 % triethyl amine. Successively, the membrane received a heat treatment of heating at 120 °C for 2 hours under a reduced pressure by a rotary pump.

Subsequently, the membrane was treated in accordance with the same procedures as those in Example 1. The electrolyte membrane is referred to as Example 22. Further, electric conductivity was measured, and the creep resistance was evaluated in the same manner as in Example 16.

Table 3 shows the treatment conditions and the result of measurement of various characteristics of electrolyte membranes obtained in Examples 16 to 22 and Comparative Example

1.

[Table 3]

Sample	Ammonia Treatment Time	Heat Treatment Condition	Base Treatment Condition	Electric Conductivity (S/cm)	Creep Elongation	
					After 1 minute (%)	After 8 minutes (%)
Example 16	2 days	120°C 3 days	—	7.55×10^{-2}	50	121
Example 17	5 days	120°C 3 days	—	5.54×10^{-2}	92	123
Example 18	7 days	120°C 3 days	—	4.71×10^{-2}	66	85
Example 19	10 days	120°C 3 days	—	3.92×10^{-2}	80	92
Example 20	2 days	120°C 2 hours	—	6.18×10^{-2}	75	128
Example 21	2 days	—	—	6.18×10^{-2}	150	189
Example 22	2 days	120°C 2 hours	Triethyl-amine 100°C 5 hours	7.20×10^{-2}	72	103
Comparative Example 1	—	—	—	7.14×10^{-2}	121	189

In Examples 16 to 19 in which the conditions of the heat treatment conducted after the amine treatment were made

constant while the amine treatment time was changed, creep elongation for 1 minute and 8 minutes were greatly decreased compared with Comparative Example 1, and the creep resistance was improved. Further, the electric conductivity was higher as the ammonia treating time was shorter. Particularly, in Example 16, higher electric conductivity than Comparative Example 1 was shown.

That is, it can be seen that both the creep resistant property and the electric conductivity are improved as the amine treatment time is shorter in the case where the heat treatment conducted after the amine treatment step is constant as is the case where the amine compound used is ammonia. Further, it can be understood that the optimal time for conducting the amine treatment varies depending on the kind of the amine compounds used, and that the amine treatment time has to be changed depending on the kind of the amine compound.

Further, when Examples 16, 20 and 21, in which the ammonia treatment time is identical, are compared, it can be seen that the creep elongation is decreased by the heat treatment, and the electric conductivity and creep resistant property are improved as the heat treatment time is longer.

From the foregoing, it can be seen that the electrolyte can be reformed by properly controlling the amine treatment time and the heat treatment conditions and the like in accordance with the conditions and the application use of the electrolyte so that desired electric conductivity and creep resistant property are obtained.

Further, in Example 22 in which the amine treatment, the base treatment and the heat treatment were conducted in this order, creep elongation was identical with Example 20 where the base treatment was not conducted. However, the electric conductivity was higher than Example 20 and identical with Comparative Example 1.

The reason why the electric conductivity was not lowered in the case of conducting the base treatment as described above may be considered that protons at crosslinked points are released more easily by the action of the base as a proton acceptor at the crosslinked points.

(Example 23)

A suspended solution of a 5 ml THF solution including 500 mg of sodium amide as the amine compound was added to 80 ml of a flon solvent (R113) in which a Nafion membrane (F112) was immersed, and the membrane was immersed for two days. Then, the membrane was taken out and washed with R113 and THF solutions. Successively, the membrane received a heat treatment of heating at 120 °C for 2 hours under a reduced pressure by a rotary pump. Subsequently, the membrane was treated in accordance with the same procedures as those in Example 1. The electrolyte membrane is referred to as Example 23. Further, electric conductivity was measured, and the creep resistance was evaluated in the same manner as in Example 1.

(Example 24)

The membrane was treated in accordance with the same

procedures as those in Example 16 except for using 1 ml of 1-hexylamine as an amine compound. The electrolyte membrane is referred to as Example 24. Further, the electric conductivity was measured, and the creep resistance was evaluated in the same manner as in Example 1.

Table 4 shows the treatment conditions and the result of measurement of various characteristics of electrolyte membranes obtained in Examples 23 and 24 and Comparative Example 1.

[Table 4]

Sample	Amine Compound	Amine Treatment Time	Heat Treatment Condition	Electric Conductivity (S/cm)	Creep Elongation after 1 minute (%)
Example 23	Sodium Amide	2 days	120°C 3 days	3.5×10^{-2}	40
Example 24	1-Hexyl Amine	2 days	120°C 3 days	4.8×10^{-2}	90
Comparative Example 1	—	—	—	7.14×10^{-2}	121

In Examples 23 and 24 in which sodium amide as the metal amide and 1-hexylamine as the primary amine were used respectively as the amine compounds, the creep elongation decreased compared with Comparative Example 1 and the creep resistance was improved in the same manner as in the foregoing examples. On the other hand, the electric conductivity was lowered compared with Example 16 shown in Table 3.

In Example 16 in which ammonia as the amine compound was used, both the electric conductivity and the creep resistant property were improved compared with Comparative

Example 1, and it can be seen that the ammonia is suitable as the amine compound.

Then, elemental analysis was conducted with an aim of examining the molar fraction of the amount of nitrogen derived from the amine compound relative to the total number of sulfonic acid groups in the perfluoro polymer electrolyte. As a result, the nitrogen molar fraction relative to the total number of sulfonic acid groups N_{sul} (%) was 1.5 % in Example 1, 4.2 % in Example 2, 9.3 % in Example 3 and 17 % in Example 4. Fig. 3 shows a relation between the nitrogen molar fraction relative to the total number of sulfonic acid groups N_{sul} (%), the creep elongation for one minute and the electric conductivity.

As can be seen from Fig. 3, it exhibited a behavior that the creep elongation for one minute abruptly decreased along with increase in the nitrogen molar fraction N_{sul} (%) up to about 10 % and was settled substantially constant subsequently. Further, while the electric conductivity was not lowered so much up to the nitrogen molar fraction N_{sul} (%) of about 5 %, the decreasing ratio of the electric conductivity increased in excess of the molar fraction of 10 %.

From the result, it can be seen that the effect on an improvement in the creep resistant property is insufficient in the case that the nitrogen molar ratio N (%) is excessively small. On the other hand, the creep resistant property is improved, but the electric conductivity is lowered in the case that the nitrogen molar fraction N (%) is excessive.

Then, description is to be made to a result of

measurement of the distribution of nitrogen density $n(\%)$ on the membrane cross section (nitrogen molar ratio $N(\%)$ per unit volume). Fig. 4 shows a nitrogen density distribution on a membrane cross section in Example 4 using LBTMSA as an amine compound, and Fig. 5 shows a nitrogen density distribution on a membrane cross section in Example 17 using ammonia as an amine compound.

As shown in Fig. 4, in the membrane of Example 4, peaks of the nitrogen density $n(\%)$ are present locally on the surface of the membrane forming a nonuniform distribution. Further, the maximum value n_{\max} reaches as far as about 75 %. On the other hand, as shown in Fig. 5, in the membrane of Example 17, distribution of the nitrogen density $n(\%)$ is uniform over the entire membrane cross section. Further, the maximum value n_{\max} is within a range from 10 % to 20 % thus showing a nitrogen density distribution quite different from that of Example 4.

This may be caused by that a reaction was taken place locally near the surface of the membrane before the amine compound diffused to the central portion of the membrane in Example 4, since LBTMSA having a diffusion rate in the perfluoro polymer electrolyte membrane is lower than the reaction rate with the perfluoro polymer electrolyte membrane is used as the amine compound.

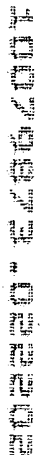
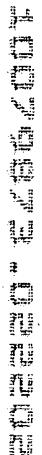
On the other hand, it may be considered that in Example 17, the amine compound was sufficiently diffused to the central portion of the membrane, and then the reaction was taken place uniformly over the entire membrane since ammonia having a

[illegible][illegible]


REPORT OF THE

REPORT OF THE

REPORT OF THE

[illegible][illegible]

[illegible]
$$-(CF_2-CF)_m-(CF_2-CF_2)_n-$$



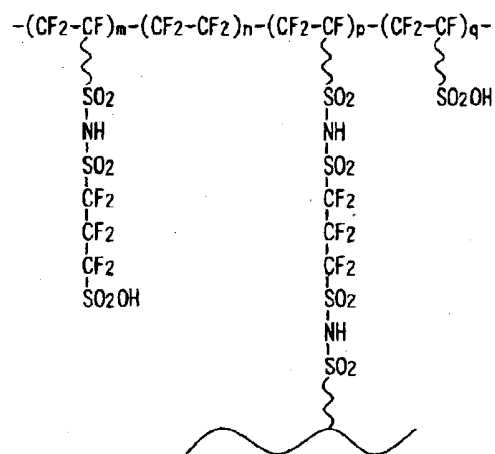
 SO₂NH₂

[illegible]

64

were converted into the complete proton type. The chemical formula 4 shows a molecular structure of the obtained modified electrolyte membrane.

[Chemical formula 4]



The modified electrolyte membrane obtained in this example has, as shown in the chemical formula 4, a multifunctional side chain having a sulfonic acid group (terminal acid group) and a bisulfonyl imide group (intermediate acid group), and a crosslink structure having two bisulfonylimide groups (acidic crosslinking group). The chemical formula 4 schematically shows that among the side chains contained in the Nafion 112F membrane, m side chains become a multifunctional side chain by the reaction with the modifying agent, p side chains are consumed by crosslinking with other Nafion molecules (schematically shown by the wave shape line in the chemical formula 4), and q side chains are not consumed in the reaction with the modifying agent (the letters, m , p , and q represent the numbers of the side chains). (Example 32)

A modified electrolyte membrane was prepared in accordance with the same procedures as those in Example 31 except for changing the immersion time in the modifying agent solution A to 48 hours. In this example, since the reaction time was changed to 48 hours, the reaction ratio between the modifying agent and the sulfonamide groups in the membrane was 100 %.

(Example 33)

A modified electrolyte membrane was prepared in accordance with the same procedures as those in Example 31 except for using a Nafion 111F membrane (8 cm x 8 cm, 25 μ m thickness) as the solid polymer electrolyte. In this example, the reaction ratio between the modifying agent and the sulfonamide groups in the membrane was 95 %.

(Example 34)

A modified electrolyte membrane was prepared in accordance with the same procedures as those in Example 31 except for using a Nafion 111F membrane (8 cm x 8 cm, 25 μ m thickness) as the solid polymer electrolyte and changing the immersion time in the modifying agent solution A to 48 hours. In this example, the reaction ratio between the modifying agent and the sulfonamide groups in the membrane was 100 % since the reaction time was changed to 48 hours.

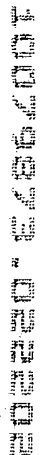
(Example 35)

A modified electrolyte membrane having multifunctional side chains was prepared in accordance with the following procedures. A Nafion 111F membrane (8 cm x 8 cm, 50 μ m

1030300

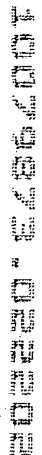
1030300

1030300



1030300

1030300

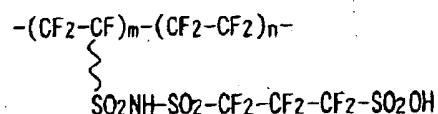


1030300

and 300 ml of water at 40 °C for 20 hours. After the reaction, the membrane was washed with a NaCl aqueous solution, and sulfonyl sodium (-SO₂Na) was introduced to the terminal end of the side chain.

Then, the membrane was immersed in 200 ml of water, a chlorine gas was bubbled at 0 °C for 2 hours, and sulfonyl sodium was converted into sulfonyl chloride. After the reaction, the membrane was washed with an aqueous solution of sodium hydrogencarbonate. Then, the membrane was immersed in a solution of KOH/dimethylsulfoxide/water = 15/35/50 at 80 °C for 8 hours, and sulfonyl chloride groups contained in the multifunctional side chains were hydrolyzed. Further, after washing the membrane with a 10 % nitric acid aqueous solution, it was washed with purified water, and hydrolyzed sulfonyl chloride groups were converted into the complete proton type. A chemical formula 7 shows the molecular structure of the obtained modified electrolyte membrane.

[Chemical formula 7]



The modified electrolyte membrane obtained in this example has the multifunctional side chain having a sulfonic acid group, (terminal acid group) and a bisulfonylimide group (intermediate acid group) as shown by the chemical formula 7. (Comparative Example 11)

The Nafion 112F membrane used in Example 31 was immersed in a solution of KOH/dimethylsulfoxide/water = 15/35/50 at 80

°C for 8 hours, and sulfonyl fluoride groups were hydrolyzed. Then, after washing the membrane with a 10 % nitric acid aqueous solution, it was washed with distilled water to obtain a Nafion 112 membrane.

(Comparative Example 12)

A Nafion membrane 111 was obtained in accordance with the same procedures as those in Comparative Example 11 except for using the Nafion 111F membrane used in Example 33.

The modified electrolyte membranes obtained in Examples 31 to 35 and Nafion membranes obtained in Comparative Examples 11 and 12 were evaluated in terms of the electric conductivity and the creep characteristic. Further, after bonding platinum carbon electrodes on both the surfaces of the resultant electrolyte membrane, fuel cells were manufactured using them, and the output characteristics were evaluated. Table 5 shows the reaction ratio with ammonia, the reaction ratio with the modifying agent, the electric conductivity, the creep elongation, and the output voltage.

[Table 5]

	Reaction Ratio with Ammonia (%)	Reaction Ratio with Modifier (%)	Electric Conductivity (S/cm)	Creep Elongation (%)	Output Voltage (V)
Example 31	100	92	0.112	62	0.48
Example 32	100	100	0.135	58	0.54
Example 33	100	95	0.108	55	0.63
Example 34	100	100	0.143	53	0.72
Example 35	100	100	0.152	220	0.72
Comparative Example 11	—	—	0.078	300	0
Comparative Example 12	—	—	0.080	350	0

The electric conductivity was calculated based on the membrane resistance determined in purified water at 25 °C by an AC method (measuring frequency: 10 kHz) and a membrane thickness. Further, a stress of 0.8 MPa was given to the membrane at 160 °C, and after 4 minutes, the creep characteristic was evaluated in terms of the creep elongation. Further, the output characteristic was evaluated in terms of an output voltage at a current density of 0.5 A/cm² at a cell temperature of 105 °C and a humidifying bubbler temperature of 60 °C during a steady operation under the reaction gas supply condition shown in Table 6.

[Table 6]

Evaluating Condition:

Cell Temperature 105°C, Humidifying Bubbler Temperature 60°C		
	Cathode	Anode
Gas	Air	Hydrogen
Bubbler Temperature	60°C	60°C
Stoichiometry*	1.8	1.2
Pressure	2ata	2ata

*) Current Density 0.5A/cm²

In the Nafion membranes obtained by Comparative Example 11 and Comparative Example 12, the electric conductivity was less than 0.1 S/cm, and the creep elongation was 300 % or more in each of the examples. Further, the fuel cell using the Nafion membrane did not operate under the low humidity · high temperature condition shown in Table 6, and the output voltage was 0 V in each of the examples.

On the other hand, in the modified electrolyte Example 35 with the introduction of the multifunctional side chains only, the creep elongation was 220 %, and no remarkable improvement was found in the creep resistant property compared with Comparative Example 12. However, the electric conductivity was 0.152 S/cm which was improved about twice as high as the Comparative Example 12. Further, the manufactured fuel cell operated stably even under the low humidity-high temperature condition in Table 6, and output voltage of 0.72 V was obtained.

Further, in the modified electrolyte of Example 31 to

34 with the introduction of both the multifunctional side chains and the crosslink structure, the electric conductivity was 0.1 S/cm or more in each of the examples and improved compared with Comparative Example 11. Further, the creep elongation was 53 to 62 %, which was about 1/5 or less of Comparative Example 11. This is because the amount of acid group increased with the introduction of the multifunctional side chains, and the flows of molecules at high temperatures were suppressed by the polymers crosslinked via the acidic crosslinking groups.

Further, each of the cells using the membranes obtained in Examples 31 to 34 operated stably even under the low humidity-high temperature condition in Table 6, and 0.48 to 0.72 V of output voltage was obtained in accordance with the conditions of manufacturing the membranes. It is considered that the output voltage becomes higher as the reaction time with the modifying agent solution is longer because the amount of the multifunctional side chains introduced is increased as the reaction time is longer. Further, it is considered that the output voltage is higher as the thickness of the membrane is reduced because water formed at the cathode diffuses more easily toward the anode as the thickness of the membrane is reduced, and the membrane is maintained in an appropriate hydrous state.

Fig. 6 shows a relation between the cell temperature and the output voltage at a current density of 0.5 A/cm² of a fuel cells using the electrolyte membranes obtained in

Example 32 and Comparative Example 11. It can be seen from Fig. 6 that the output voltage lowers abruptly when the cell temperature exceeds 100 °C in Comparative Example 11, whereas the fuel cell operates stably even under the low humidity-high temperature condition in which the cell temperature exceeds 100 °C in Example 32.

(Example 36)

At first, in accordance with the same procedures as those in Example 31, amidization of sulfonyl fluoride groups contained in the Nafion 112F membrane and a reaction of the amidized Nafion 112F membrane with the modifying agent solution A were conducted, and the multifunctional side chain and the crosslink structure were introduced into the membrane. After the reaction, the membrane was immersed in 200 ml of tetrahydroxyfuran and unreacted reagent was removed.

Further, for the thus obtained membrane, amidization of the sulfonyl fluoride groups contained in the membrane and the reaction between the amidized membrane and the modifying agent solution A were conducted again in accordance with the same procedures as those in Example 31. In this example, both the reaction ratio between the sulfonyl fluoride group and ammonia and the reaction ratio between the modifying agent and the sulfonamide groups in the membrane were 100 %. After the reaction, the membrane was immersed in a solution of KOH/dimethylsulfoxide/water = 15/35/50 at 80 °C for 8 hours, and hydrolysis was conducted. Further, after cleaning the membrane with a 10 % nitric acid aqueous solution, it was

further washed with distilled water to obtain a modified electrolyte membrane.

For the thus obtained modified electrolyte membrane, the electric conductivity, the creep elongation and the output characteristic were measured under the same conditions as those in Example 31. As a result, the electric conductivity was 0.165 S/cm, and the creep elongation was 49 %. Further, the fuel cell using the modified electrolyte membrane operated stably under the low humidity-high temperature condition shown in Table 6, and 0.69 V of output voltage was obtained. (Example 37)

10 g of PEEK (polyether ether ketone, manufactured by Mitsui Chemical Co.) was dissolved in 100 ml of concentrated sulfuric acid and reacted at a room temperature for 100 hours. Then, the resultant liquid solution was poured into 1 l of water to precipitate sulfonated PEEK (hereinafter referred to as "s-PEEK"). The precipitates were filtered and washed with water. The sulfonation ratio of the resultant s-PEEK was 80 %.

Then, s-PEEK membrane of 50 μ m thickness was prepared from a solution of s-PEEK in a water/ethanol solution. Then, the membrane (8 cm x 8 cm) was immersed in a solution containing 30 g of thionyl chloride and 300 ml of tetrahydrofuran at 50 °C for 10 hours to chlorinate the sulfonic acid groups of the s-PEEK membrane. After the reaction, the membrane was immersed in a 300 ml solution of tetrahydrofuran to remove unreacted thionyl chloride.

Further, for the resultant membrane (8 cm x 8 cm, 50

μm thickness), amidization treatment, reaction with the modifying agent solution A, hydrolysis and protonating treatment of the membrane were conducted under the same conditions as those in Example 1. In this example, both the reaction ratio between the sulfonyl chloride groups and ammonia and the reaction ratio between the modifying agent and sulfonamide groups in the membrane were 100 %.

For the resultant modified electrolyte membrane, the electric conductivity, the creep elongation and the output characteristics were measured under the same conditions as those in Example 31. As a result, the electric conductivity was 0.165 S/cm, and the creep elongation was 5 %. Further, the fuel cell using the modified electrolyte membrane operated stably under low humidity-high temperature condition shown in Table 6, and 0.56 V of output voltage was obtained.

(Example 38)

4,4'-diamino-2,2'-biphenyl disulfonic acid and 1,4,5,8-naphthalene tetracarboxylic acid dianhydride were dissolved at a molar ratio of 1:1 into cresol and reacted at 80 °C for 10 hours to synthesize polyimide. The solution was cast to prepare polyimide membrane A of 50 μm thickness. Then, the membrane (8 cm x 8 cm) was immersed in a solution of 300 ml tetrahydrofuran including 30 g of thionyl chloride at 50 °C for 10 hours to chlorinate the sulfonic acid groups in the polyimide membrane A. After the reaction, the membrane was immersed in a solution of 300 ml of tetrahydrofuran to remove unreacted thionyl chloride.

Further, for the obtained membrane (8 cm x 8 cm, 50 μ m thickness), the amidization treatment, reaction with the modifying agent solution A, hydrolysis and protonating treatment of the membrane were conducted under the same conditions as those in Example 1. In this example, both the reaction ratio between the sulfonyl chloride groups and ammonia and the reaction ratio between the modifying agent and the sulfonamide groups in the membrane were 100 %.

For the resultant modified electrolyte membrane, the electric conductivity, the creep elongation and the output characteristic were measured under the same conditions as those in Example 31. As a result, the electric conductivity was 0.170 S/cm and the creep elongation was 5 %. Further, the fuel cell using the modified electrolyte membrane operated stably under the low humidity-high temperature condition shown in Table 6, and output voltage of 0.55 V was obtained.

(Example 39)

4,4'-diamino-2,2'-biphenyl disulfonic acid, 4,4'-(9-fluorenylidenediamine) and 1,4,5,8-naphthalene tetracarboxylic acid dianhydride were dissolved at a molar ratio of 0.95:0.05:1 into cresol and reacted at 80 °C for 10 hours to synthesize a polyimide. The solution was cast to prepare a polyimide membrane B of 50 μ m thickness. Then, the obtained membrane (8 cm x 8 cm) was immersed in a solution of 300 ml tetrahydrofuran including 30 g of thionyl chloride at 50 °C for 10 hours to chlorinate the sulfonic acid groups in the polyimide membrane B. After the reaction, the membrane

was immersed in a 300 ml solution of tetrahydrofuran to remove unreacted thionyl chloride.

Further, for the obtained membrane (8 cm x 8 cm, 50 μ m thickness), the amidization treatment, reaction with the modifying agent solution A, hydrolysis and the protonating treatment of the membrane were conducted under the same conditions as those in Example 1. In this example, both the reaction ratio between the sulfonyl chloride groups and ammonia and the reaction ratio between the modifying agent and the sulfonamide groups in the membrane were 100 %.

For the obtained modified electrolyte membrane, the electric conductivity, the creep elongation and the output characteristic were measured under the same conditions as those in Example 31. As a result, the electric conductivity was 0.175 S/cm, and the creep elongation was 6 %. Further, the fuel cell using the modified electrolyte membrane operated stably under the low humidity-high temperature condition shown in Table 6, and output voltage of 0.56 V was obtained.

(Example 40)

4,4'-diamino-2,2'-biphenyl disulfonic acid, 4,4'-oxydianiline and 1,4,5,8-naphthalene tetracarboxylic acid dianhydride were dissolved at a molar ratio of 0.95:0.05:1 into cresol and reacted at 80 °C for 10 hours to synthesize a polyimide. The solution was cast to prepare a polyimide membrane C of 50 μ m thickness. Then, the membrane (8 cm x 8 cm) was immersed in a solution of 300 ml tetrahydrofuran including 30 g of thionyl chloride at 50 °C for 10 hours to

chlorinate the sulfonic acid groups in the polyimide membrane C. After the reaction, the membrane was immersed in a 300 ml solution of tetrahydrofuran to remove unreacted thionyl chloride.

Further, for the obtained membrane (8 cm x 8 cm, 50 μ m thickness), the amidization treatment, reaction with the modifying agent solution A, hydrolysis and the protonating treatment of the membrane were conducted under the same conditions as those in Example 31. In this example, both the reaction ratio between the sulfonyl chloride groups and the ammonia and the reaction ratio between the modifying agent and the sulfonamide groups in the membrane were 100 %.

For the obtained modified electrolyte membrane, the electric conductivity, the creep elongation and the output characteristic were measured under the same conditions as those in Example 31. As a result, the electric conductivity was 0.176 S/cm, and the creep elongation was 7 %. Further, the fuel cell using the modified electrolyte membrane operated stably under the low humidity-high temperature condition shown in Table 6 and output voltage of 0.55 V was obtained.

(Example 41)

An ETFE membrane (ethylene-tetrafluoroethylene copolymer, 8 cm x 8 cm, 50 μ m thickness) irradiated with electron rays were immersed in a solution comprising 588 ml of styrene, 12 ml of divinyl benzene and 300 ml of xylene at 60°C for 5 hours to obtain an ETFE-grafted-polystyrene membrane. The graft ratio was 45 %. The membrane was immersed in a

00223 4464001

solution comprising 20 ml of chlorosulfonic acid and 500 ml of dichloroethane at 60 °C for one hour to sulfonate a polystyrene portion. Subsequently, the membrane was immersed in 500 ml of dichloro ethane to remove unreacted reagent.

Further, for the obtained membrane (8 cm x 8 cm, 50 μ m thickness), the amidization treatment for the membrane, reaction with the modifying agent solution A, hydrolysis and the protonating treatment were conducted under the same conditions as those in Example 31. In this example, both the reaction ratio between the sulfonyl chloride groups and ammonia and the reaction ratio between the modifying agent and the sulfonamide groups in the membrane were 100 %.

For the obtained modified electrolyte membrane, the electric conductivity, the creep elongation and the output characteristic were measured under the same conditions as those in Example 31. As a result, the electric conductivity was 0.190 S/cm, and the creep elongation was 3 %. Further, the fuel cell using the modified electrolyte membrane operated stably under the low humidity-high temperature condition shown in Table 6 and output voltage of 0.50 V was obtained.
(Comparative Example 13)

For the s-PEEK membrane (50 μ m thickness) synthesized in Example 37, the electric conductivity, the creep elongation and the output characteristic were measured under the same conditions as those in Example 31. As a result, the electric conductivity was 0.105 S/cm, and the creep elongation was 15 %. Further, the fuel cell using the membrane did not operate under

the low humidity-high temperature condition in Table 6, and no output voltage was obtained.

(Comparative Example 14)

For the polyimide membrane A (50 μm thickness) synthesized in Example 38, the electric conductivity, the creep elongation and the output characteristic were measured under the same conditions as those in Example 31. As a result, the electric conductivity was 0.115 S/cm, and the creep elongation was 10 %. Further, the fuel cell using the membrane did not operate under the low humidity-high temperature condition in Table 6, and no output voltage was obtained.

(Comparative Example 15)

For the polyimide membrane B (50 μm thickness) synthesized in Example 39, the electric conductivity, the creep elongation and the output characteristic were measured under the same conditions as those in Example 31. As a result, the electric conductivity was 0.120 S/cm, and the creep elongation was 10 %. Further, the fuel cell using the membrane did not operate under the low humidity-high temperature condition in Table 6, and no output voltage was obtained.

(Comparative Example 16)

For the polyimide membrane C (50 μm thickness) synthesized in Example 40, the electric conductivity, the creep elongation and the output characteristic were measured under the same conditions as those in Example 31. As a result, the electric conductivity was 0.121 S/cm, and the creep elongation was 12 %. Further, the fuel cell using the membrane did not

operate under the low humidity-high temperature condition in Table 6, and no output voltage was obtained.

(Comparative Example 17)

For the sulfonated ETFE-g-PS membrane (50 μm thickness) synthesized in Example 41, the electric conductivity, the creep elongation and the output characteristic were measured under the same conditions as those in Example 31. As a result, the electric conductivity was 0.135 S/cm, and the creep elongation was 10 %. Further, the fuel cell using the membrane did not operate under the low humidity-high temperature condition in Table 6, and no output voltage was obtained.

Table 7 shows the reaction ratio of the membranes obtained in Examples 36 to 41 and Comparative Examples 13 to 17 with ammonia, the reaction ratio of the membrane with the modifying agent, the electric conductivity, the creep elongation, and the output voltage.

[Table 7]

	Reaction Ratio with Ammonia (%)	Reaction Ratio with Modifier (%)	Electric Conductivity (S/cm)	Creep Elongation (%)	Output Voltage (V)
Example 36	100	100	0.165	49	0.69
Example 37	100	100	0.165	5	0.56
Example 38	100	100	0.170	5	0.55
Example 39	100	100	0.175	6	0.56
Example 40	100	100	0.176	7	0.55
Example 41	100	100	0.190	3	0.50
Comparative Example 13	—	—	0.105	15	0
Comparative Example 14	—	—	0.115	10	0
Comparative Example 15	—	—	0.120	10	0
Comparative Example 16	—	—	0.121	12	0
Comparative Example 17	—	—	0.135	10	0

(Example 42)

A modified electrolyte was prepared in accordance with the same procedures as those in Example 34 except for changing the treatment time with the ammonia gas to 45 minutes and changing the conversion ratio from sulfonyl fluoride groups to sulfonamide groups (reaction ratio with ammonia) to 72 %.

(Example 43)

A modified electrolyte was prepared in accordance with the same procedures as those in Example 34 except for changing the treatment time with the ammonia gas to 30 minutes and changing the conversion ratio from sulfonyl fluoride groups to sulfonamide groups to 51 %.

(Example 44)

A modified electrolyte was prepared in accordance with the same procedures as those in Example 34 except for changing the treatment time with the ammonia gas to 15 minutes and changing the conversion ratio from sulfonyl fluoride groups to sulfonamide groups to 30 %.

(Example 45)

A modified electrolyte was prepared in accordance with the same procedures as those in Example 34 except for changing the treatment time with the ammonia gas to 10 minutes and changing the conversion ratio from sulfonyl fluoride groups to sulfonamide groups to 20 %.

(Example 46)

A modified electrolyte was prepared in accordance with the same procedures as those in Example 34 except for using a fluoro material of a perfluoro electrolyte membrane reinforced with a porous PTFE sheet (membrane thickness; 30 μm , manufactured by W.L.Gore & Associates) as an electrolyte membrane. In this example, both the reaction ratio with ammonia and the reaction ratio with the modifying agent were 100 %.

(Example 47)

A modified electrolyte was prepared in accordance with the same procedures as those in Example 34 except for using tri(3-fluorosulfonyl-hexafluoropropyl)amine($\text{N}(\text{CF}_2\text{CF}_2\text{CF}_2\text{SO}_2\text{F})_3$) as the modifying agent. In this example, both the reaction ratio with ammonia

and the reaction ratio with the modifying agent were 100 %.
(Comparative Example 18)

As the electrolyte membrane, a perfluoroelectrolyte membrane reinforced with a porous PTFE sheet (membrane thickness; 30 μm manufactured by W.L.Gore & Associates) was used for the experiment as it was.

For the membranes obtained in Examples 42 to 47 and Comparative Example 18, the electric conductivity, the creep elongation and the output characteristic were measured under the same conditions as those in Example 31. Table 8 shows the reaction ratio with ammonia, the reaction ratio with the modifying agent, the electric conductivity, the creep elongation, and the output voltage.

[Table 8]

	Reaction Ratio with Ammonia (%)	Reaction Ratio with Modifier (%)	Electric Conductivity (S/cm)	Creep Elongation (%)	Output Voltage (V)
Example 42	72	100	0.128	85	0.68
Example 43	51	100	0.118	104	0.63
Example 44	30	100	0.107	124	0.52
Example 45	20	100	0.095	150	0.42
Example 46	100	100	0.135	20	0.69
Example 47	100	100	0.165	64	0.75
Comparative Example 18	—	—	0.075	25	0

It can be seen from Examples 42 to 45 that the electric conductivity increases, and the creep elongation decreases as the treatment time with the ammonia gas is longer in a case

of reacting the Nafion 111F and the ammonia gas. This may be attributable to that the conversion ratio of the sulfonyl fluoride groups in the membrane to the sulfonamide groups increases as the treatment time with the ammonia gas is longer, whereby more multifunctional side chains and the crosslinking groups are introduced into the membrane. Further, the fuel cells using the membranes operated stably under low humidity-high temperature conditions shown in Table 6 and an output voltage from 0.42 to 0.68 V was obtained in accordance with the preparation conditions of the membranes.

On the other hand, in the perfluoro polymer electrolyte membrane reinforced with the porous PTFE sheet (Comparative Example 18), the electric conductivity was 0.075 S/cm and the creep elongation was 25 %. The fuel cells using the membranes did not operate under the low humidity-high temperature conditions shown in Table 6, and no output voltage was obtained.

On the contrary, in Example 46 in which multifunctional side chains were introduced to the electrolyte membrane of Comparative Example 18, the electric conductivity was 0.135 S/cm, and the creep elongation was 20 %. Both were improved compared with Comparative Example 18. Further, the fuel cells using the membranes operated stably under low humidity-high temperature conditions and 0.69 V of output voltage was obtained.

Further, in Example 47 in which tri(3-fluorosulfonyl-hexafluoropropyl)amine($\text{N}(\text{CF}_2\text{CF}_2\text{CF}_2\text{SO}_2\text{F})_3$) was used as the modifying agent, the creep elongation was 64 %,

which was about equal to Example 34, but the electric conductivity was 0.165 S/cm which was improved compared with Example 34. It may be considered that since the tri-functional reagent having three sulfonyl fluoride groups was used as the modifying agent, the amount of acid groups introduced per one side chain was increased. Further, the fuel cell using the membrane operated stably under the low humidity-high temperature condition shown in Table 6 and an output voltage of 0.75 V was obtained.

The present invention is not restricted at all to the embodiments described above but may be modified variously. Its modifications and variations are encompassed within the scope of the present invention so long as they have identical technical ideas with those of the present invention.

For example, the process for producing the modified electrolyte according to the second and the third embodiments of the present invention has a feature in reacting a solid polymer compound having a relatively small number of functional groups A with a modifying agent thereby forming multifunctional side chains to increase the number of acid groups in the entire electrolyte. Accordingly, by applying the process according to the present invention, it is possible to produce a solid polymer electrolyte having not only the multifunctional side chains but also side chains having two or more intermediate acid groups alone.

Further, in the embodiments described above, while the method of using a predetermined modifying agent has been

explained as a process for producing a modified electrolyte having multifunctional side chains and a crosslink structure, the method of introducing the crosslink structure is not restricted thereto. For example, after introducing the multifunctional side chains into the solid polymer compound by using a modifying agent, the electrolyte may be reacted with a usual crosslinker (for example, a UV-curing type amine crosslinker) thereby introducing a crosslink structure.

Further, while the modified electrolyte according to the present invention is suitable as an electrolyte for use in electrochemical devices used under severe conditions such as fuel cells or SPE devices, the application use of the present invention is not restricted to the fuel cell or the SPE electrolysis device, but it can be also used as an electrolyte for use in various types of electrochemical devices such as a halogen hydracid electrolysis device, a sodium chloride electrolysis device, a hydrogen and/or oxygen concentrator, a humidity sensor and a gas sensor.

The foregoing description of the preferred embodiments of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and modifications and variations are possible in the light of the above teachings or may be acquired from practice of the invention. The embodiments chosen and described in order to explain the principles of the invention and its practical application to enable one skilled in the art

to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto, and their equivalents.

30079873-00000000

What Is Claimed Is:

1. A process for producing a modified electrolyte comprising an amine treatment step of contacting a solid polymer electrolyte or a precursor thereof with an amine compound.

2. The process for producing the modified electrolyte according to claim 1, further comprising a heat treatment step of heating the solid polymer electrolyte or the precursor thereof after the amine treatment step.

3. The process for producing the modified electrolyte according to claim 1, further comprising a base treatment step of contacting the solid polymer electrolyte or the precursor thereof, with a base after the amine treatment step.

4. The process for producing the modified electrolyte according to claim 2, further comprising a base treatment step of contacting the solid polymer electrolyte or the precursor thereof, with a base after the amine treatment step.

5. The process for producing the modified electrolyte according to claim 1, wherein the solid polymer electrolyte is a perfluoro polymeric electrolyte.

6. The process for producing the modified electrolyte according to claim 1, wherein the amine compound is at least one compound selected from the group consisting of ammonia, alkali metal bis(trimethylsilyl)amide, sodium amide, 1-hexylamine, ethylamine, propylamine, butylamine, pentylamine, heptylamine, nonylamine, decylamine, perfluoromethylamine, perfluoroethylamine, perfluorobutylamine,

perfluoropentylamine and perfluoroheptylamine.

7. The process for producing the modified electrolyte according to claim 1, wherein the amine compound has a diffusion rate in the solid polymer electrolyte or the precursor thereof which is higher than the reaction rate with the solid polymer electrolyte or the precursor thereof.

8. The process for producing the modified electrolyte according to claim 1, wherein the base is at least one compound selected from the group consisting of:

trimethylamine, triethylamine, pyridine, DBU (1,8-diazabicyclo[5.4.0]-7-undecane) and DBN (1,5-diazabicyclo[4.3.0]non-5-ene);

sodium hydroxide, lithium hydroxide, calcium hydroxide, aluminum hydroxide, potassium hydroxide, sodium carbonate, potassium carbonate, sodium hydrogencarbonate and sodium alkoxide;

sodium hydride, potassium hydride, calcium hydride, lithium aluminum hydride, sodium borohydride; and

butyl lithium, sodium cyclopentadienide and phenyl lithium.

9. The modified electrolyte obtained using the process according to claim 1.

10. An electrochemical device using the modified electrolyte according to claim 9.

11. A solid polymer electrolyte fuel cell using the modified electrolyte according to claim 9.

12. The modified electrolyte obtained using the process

according to claim 2.

13. An electrochemical device using the modified electrolyte according to claim 12.

14. A solid polymer electrolyte fuel cell using the modified electrolyte according to claim 12.

15. The modified electrolyte obtained using the process according to claim 3.

16. An electrochemical device using the modified electrolyte according to claim 15.

17. A solid polymer electrolyte fuel cell using the modified electrolyte according to claim 15.

18. The modified electrolyte obtained using the process according to claim 4.

19. An electrochemical device using the modified electrolyte according to claim 18.

20. A solid polymer electrolyte fuel cell using the modified electrolyte according to claim 18.

21. A process for producing a modified electrolyte comprising a first step of:

introducing, to a solid polymer compound having a functional group A, a first modifying agent comprising at least one functional group B capable of reacting with the functional group A thereby forming a first intermediate acid group and at least one functional group C capable of forming a terminal acid group or a second intermediate acid group; and

reacting the functional group A with the functional group B.

22. The process for producing the modified electrolyte according to claim 21, wherein the process further comprises a second step of:

introducing, to the solid polymer compound having been reacted with the first modifying agent, a second modifying agent comprising at least one functional group D capable of reacting with the first or second intermediate acid group and at least one functional group E capable of forming a terminal acid group or a third intermediate acid group; and

reacting the first or second intermediate acid group with the functional group D.

23. A modified electrolyte comprising:

a solid polymer compound having side chains;

at least one terminal acid group present at terminal ends of the side chains; and

at least one intermediate acid group and/or modified acid group present within the side chains identical with the side chains containing the terminal acid group.

24. The modified electrolyte according to claim 23, wherein the intermediate acid group is at least one selected from the group consisting of a bisulfonoyl imide group, a sulfonoyl carbonyl imide group, and a biscarbonyl imide group.

25. The modified electrolyte according to claim 23, wherein, the terminal acid group is at least one selected from the group consisting of a sulfonic acid group, a carboxylic acid group, and a phosphonic acid group.

26. The modified electrolyte according to claim 23,

wherein the solid polymer compound is a perfluoro polymeric compound.

27. The modified electrolyte according to claim 23, wherein a crosslinking group for crosslinking the solid polymer compounds is further provided.

28. The modified electrolyte according to claim 27, wherein the crosslinking group is at least one selected from the group consisting of a bisulfonfyl imide group, a sulfonfyl carbonyl imide group, and a biscarbonyl imide group.

29. The modified electrolyte according to claim 23, wherein the electroconductivity is 0.05 S/cm or higher.

30. The modified electrolyte according to claim 23, wherein the creep elongation formed by applying 0.8 MPa of stresses at 160 °C for 4 minutes is 150 % or less.

31. The modified electrolyte according to claim 23, wherein the modified electrolyte is obtained by:

introducing, to the solid polymer compound having a functional group A, a first modifying agent comprising at least one functional group B capable of reacting with the functional group A thereby forming a first intermediate acid group and at least one functional group C capable of forming the terminal acid group or a second intermediate acid group; and

reacting 20 % to 100 % of the functional group A with the functional group B.

32. The modified electrolyte according to claim 31, wherein the functional group A is a sulfonamide group, and the functional group B is at least one selected from

the group consisting of a sulfonyl halide group, a carbonyl halide group, a phosphonyl halide group, a sulfonate ester group, a carboxylate ester group, and a phosphonate ester group.

33. An electrochemical device using the modified electrolyte according to claim 23.

34. A solid polymer electrolyte fuel cell using the modified electrolyte according to claim 23.

35. An electrochemical device using the modified electrolyte according to claim 27.

36. A solid polymer electrolyte fuel cell using the modified electrolyte according to claim 27.